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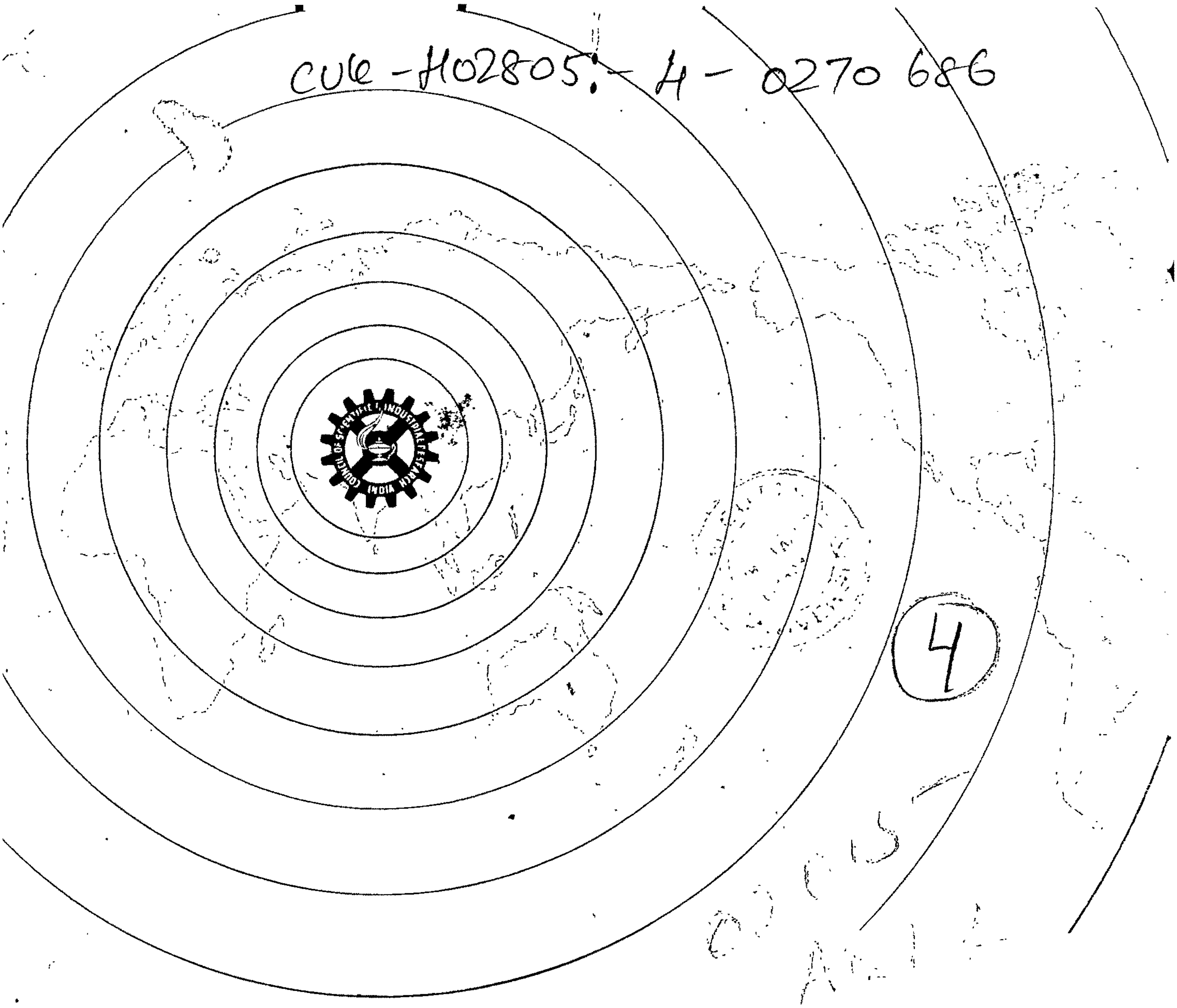

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PREPARATION OF INFORMATION FOR PROCESSING BY COMPUTER

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Discusses the need and the method of information preparation. Indicates that this stage of work requires high order of standardisation. Analyses this stage of work into coding, transcription and conversion. Points out that only conversion is amenable to some sort of mechanisation, and coding and transcription are intrinsically human operations.

INTRODUCTION

The experimental work on Information Retrieval was started at Insdoc in late 1964. Since then considerable efforts and energies have been devoted for studying the applicability of digital computers or automatic data processing systems for information retrieval work. This continuing work brought some facts to the conscious level. These are:

1) The information is transmitted by means of symbols and by concatenations of the symbols.
2) The information in the 'raw form' i.e. in the symbols of natural language can be identified by a group of persons and may have meaning as well. Outside the group, it can only be identified and has a very little meaning.
3) The symbols used for representing information to a group of persons have no acceptability to machine systems. In other words there is an absence of compatability between the symbols used in natural languages for humans and the symbols in machine language.
4) For English speaking world these symbols are A, B, C, ... Y, Z, a, b, c ... y, z ... 0, 1 ... 8, 9 some punctuation marks. For machines these are presence or absence of a hole, electric charge, a magnetisation etc. at a particular spot on a physical medium.
5) For human purposes it is possible to represent the same symbol in a variety of form and size i.e. a large variety in 'types' and calligraphic styles without changing the information. On the other hand machine handling demands a high order of standardisation both in the size and the shapes of symbols, as well as the medium on which these are recorded.
6) Because it is possible to convert symbols from one language to the symbols belonging to the other language, the translation of information expressed by strings of symbols from one language to other language is possible.
7) It is this transformation that makes the information, expressed in a language, of a group, acceptable to the other group.

These factors render 'raw information' as such unusuable by machines for further processing. In other words, raw information as such is not acceptable to machines and very frequently a preliminary set of operations are necessary in order to make the information acceptable to any mechanised or automatic systems. This set of preliminary operations may be termed as 'Information-Preparation'.

Information-Preparation

As stated earlier, the 'information-preparation' is a set of preliminary operations performed on 'raw information' in order to ensure uniformity, unambiguity, consistency and brevity. These are necessary for machine acceptability and machine manipulability of the information. In simpler and popular, though less accurate terms, the information preparation implies the transformation of information contained in a form readable by humans to a machine readable form. In practice, this is not so simple a case as it appears. Of course it is a case of translation of natural language into machine language, in its broadest sense. But various environmental factors like recording medium, converting machines etc. tend to make it complicated for further processing of information in this form by machines. Very often the converting machines decide the recording medium which in turn decides the nature and extent of information preparation. Sometimes the nature of information modifies this work.

Phases of Work

Three major phases of work are discernible in the information preparation. These are coding, transcription, and conversion. Generally these phases are sequential but it is not necessary that all of these be present in every information-preparation work. Sometimes the information preparation may mean only conversion. It must be pointed out that these phases are manual. That is, coding and transcription are essentially human operations. Conversion is, however, a semi-mechanical process. In other words conversion is amenable to mechanisation. As a matter of fact, this is the starting point of mechanisation or automation of information processing work.

Coding

'Coding' has become a sort of common-place word in information retrieval work and perhaps has attained the status of 'undefined' and 'assumed' term. Some reflection reveals that coding is a homonym and a generic term. Coding means applying a code for transforming the symbolic representation of the information. In this sense, it is merely a process of translating a natural or near-natural language into an artificial language. It also means the designing and developing an artificial language. In this sense, it implies selecting a set of symbols, assigning meanings to each element of the set, forming rules of combination of symbols, and developing rules for transformation into other languages near-natural and/or natural languages and for reverse transformation. This involves determining one-to-one correspondence between two sets of symbols and combinations of symbols. It also means transcription on coding sheets.

Levels of coding

It has been possible to identify two levels of work for coding. The first level is concerned with establishing the equivalence between each element of one set of symbols and that of the other set. In this level, it is possible that one set may be entirely oriented to human beings and the other to machines. Under such circumstances, the information represented for one group is largely unacceptable by the other. The transformation rules or transformation codes are highly arbitrary and simple. This type of codes normally aid transliterations to a very great extent. Possibly this may be the reason that this type of coding is amenable to mechanisation and it has been possible to achieve this by simple key-operated machines. This level of coding may be called as Basic coding.

The other level of coding consists in grouping, categorising and analysing the information and representing the results of these operations in terms of symbols taken from the same natural language. The effect of this level of coding is that although the symbols are identifiable by the group but these have not the traditional meanings but acquire special meanings which can only be identified by specialised sub-group. Library classification is an example of this level of coding. This coding becomes inevitable on account of various considerations of brevity, consistency, uniformity etc. It also imparts some added meaning, connotations, and context to the information. These considerations have significant import for further processing of information by machines. Frequently this level of coding serves as an intermediate link to machine coding and the code-words derived at this level are finally transformed into machines readable form by means of basic coding.

Transcription

The phase after coding may be called as Transcription phase. In this phase the nature of the information available for further processing, the medium on which the coded information is to be recorded, and the availability of conversion machines come to play dominant role in deciding the extent and method of transcription. In a popular sense, transcription is transliteration of coded information in a set of symbols belonging to an intermediate level of an artificial language. This operation has to be done by humans. It consists of writing down all that has to be converted into machine readable form in precisely predetermined manner on to what is known as coding sheet. Coding sheet is normally a larger replica of the medium acceptable by machines. The use of larger sheets of paper facilitates the manual writing process and accelerates conversion by machines.

Fixed-field

Before the transcription, it is advantageous to plan the spatial layout of the information on the coding sheets, as the unit of information may have a structure and all the elements in the structure may have to be rearranged for one reason or the other. When this happens the transcription is called 'Fixed-field' recording. In this method, a given element in a structured unit of information is recorded in given space consisting of finite recording positions. Freqeuntly, coding in the second sense is resorted to in order to achieve this.

It is not necessary to transcribe all types of information in this manner of fixed field recording. However, this manner of recording provides greater ease for conversion and increases machine manipulability of information.

Free-field

The other method of transcription is called free-field recording. It is not necessary to have a predetermined layout on the coding sheet for transcribing all the elements of a given unit of information. In this case it is not necessary to limit the size of the field for any element. What is needed is the use of 'limiters' or 'indicators' to record the end of one element of information and the beginning of the other element. In this manner of transcription the use of coding in the second sense is redundant. The entire conversion is governed by a set of pre-formulated rules. As a matter of fact, the use of coding sheet may itself appear to be superfluous. In effect the entire technique of information preparation turns out to be a matter of transliteration.

Conversion

The phase devoted by conversion consists of recording the transcribed information from coding sheets to machine acceptable recording medium in a machine readable form. Normally this is achieved by the help of keying machines which records the information on a card or paper tapes using various patterns of circular or rectangular holes. Thus machine readable information has to be either on a paper tape or card and the permissible language uses only two symbols viz. presence or absence of a hole at a particular position. That is why frequently though less accurately this recording is called 'Binary' or two state recording. In fact, this is not so as both tape and card use a two dimensional matrix recording and provide more than two ways of recording.

In practice the conversion phase consists of punching a card or a paper tape and verifying the punched card or paper tape. The punching and verification can both be done by machines.

If the transcription phase employs a concept of fixed field recording, it is possible to increase the mechanical speed of punching and verification by programming these machines with the aid of a punched card and the programme drum – a feature now-a-days available on most of the machines.

Machines for Preparation Work

At Insdoc the information preparation work is done by the Projects Division. It uses IBM card punching and verifying machines. It has one 029 and 024 card punching machine and one 056 card verifying machine. This means that the entire operations in the information preparation are card oriented so to say. That is, the recording medium for machine readable form of the information is a card. The transcription of information is done on a coding sheet which is a larger version of a card. One coding sheet has twenty horizontal lines and eighty vertical columns. Thus a coding sheet can transcribe information for twenty cards. The subsequent paragraphs describe the conversion phase of the work relating to information preparation.

Card

Most of the conversion jobs regarding information preparations are done on IBM general purpose 80 columns card. The IBM punched card is 18.73 mm. by 8.25 mm. The card is divided into 80 columns numbered 1 to 80 from the left to the right edge of the card. Each column is then divided into twelve rows out of which ten are printed from top to bottom. Each column of a card can accommodate a digit, a letter and a special character. Digits are accommodated by holes punched in the appropriate position of the card from 0 to 9. The top three punching positions of the card '12, 11 & 0' are called the zone punch. The '0' punching may be either a zone or a digit punch. Numerical digits are represented by a single punch. Letters of the alphabet are represented by combination of two holes i.e. one zone and one digit punch, e.g. Letter A is punched by a combination of '12' zone and '1' digit punch. All special characters are represented by one, two or three punches in the same column for e.g. a record mark is punched as '0, 2 & 8' punch i.e. three holes in a single column. Continued card may be used for accommodating longer units of information if desired. However, it is convenient to use one card for one type of information.

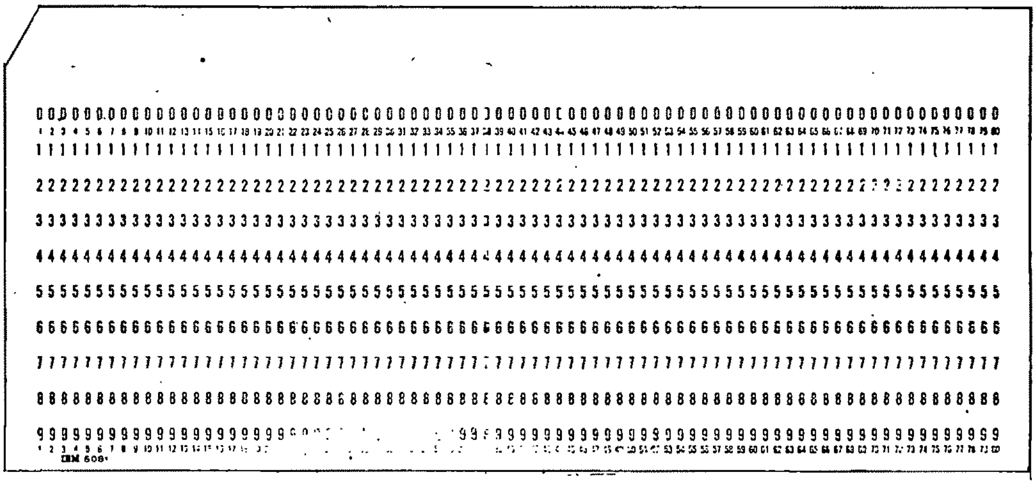

Figure 1. Illustration of a punch card

IBM 024 Card Punch

For recording the information on a card in the form of rectangular holes IBM 024, 206 or 029 punching machines may be used. The information is punched on cards by depressing different keys on a combined keyboard of alphabetic as well as numeric symbols. IBM 024 punching machine punches the holes on a card where as IBM 026 and 029 machines also print on the top of each column. In figure 2 the card is punched on IBM 024 punching machine. In this card A to Z is punched in the columns '1 to 26'. In column one letter 'A' is punched as '12' zone and '1' digit punch. 27 and 28 columns are blank, 29 column onward '0 to 9' digits are punched.

The machine is easy to operate. Several operations like 'feeding, releasing and registering the cards from hopper to stacker are automatic, just pressing the corresponding key the card is released from hopper to stacker The machine is automatic in the sense that the transport of the cards from hopper to stacker via punching station does not require operator's manual intervention.

IBM 029 Printing Card Punch

The special feature of this machine is that it prints at the top of each column of the card whatever is punched. Other operations like releasing, feeding and registering are similar to that of IBM 024 machine. This machine provides a visual check on the information punched on to a card.

Like 024 this machine too is automatic in the sense that the transport of the cards from hopper to stacker through the punching station does not require operator's intervention. This machine has some extra features like controlling the machine for two different punching programmes from the keyboard without changing the programme card on the programme drum.

PREPARATION OF INFORMATION

IBM 056 Verifier

After punching the accuracy of the punching may be mechanically checked by operating IBM 056 verifier. The punched cards are fed to a verifier through hopper. The card is transported from the hopper to stacker through the reading station. Verification is done by repeating the punching operations on 056 from the original records. In the verification process no rectangular holds are punched on the card. The card is verified column by column. A small semi-circular notch is cut at the right end of the card between zeroth and first row as shown in Fig. 4, if the card is correctly punched and verified.

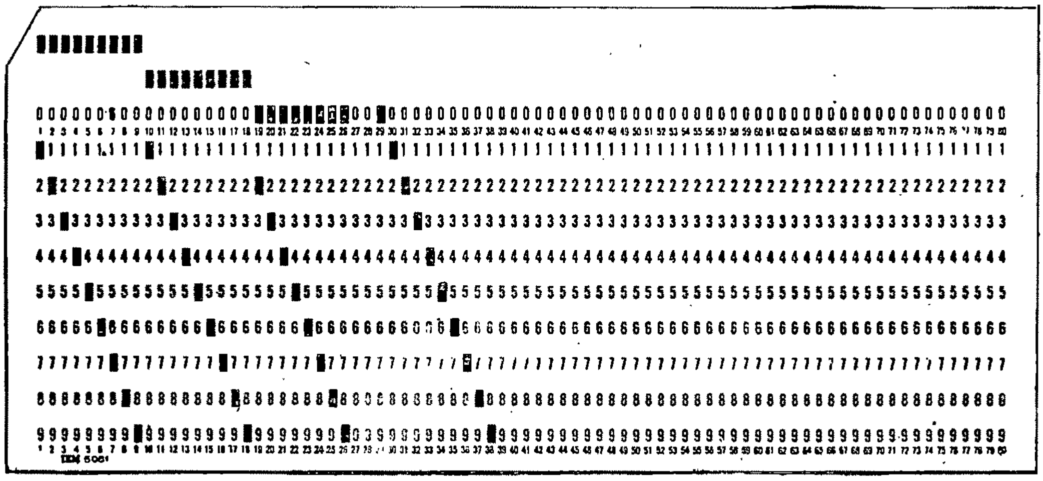

Figure 2. Card showing letters and digits punched by IBM 024

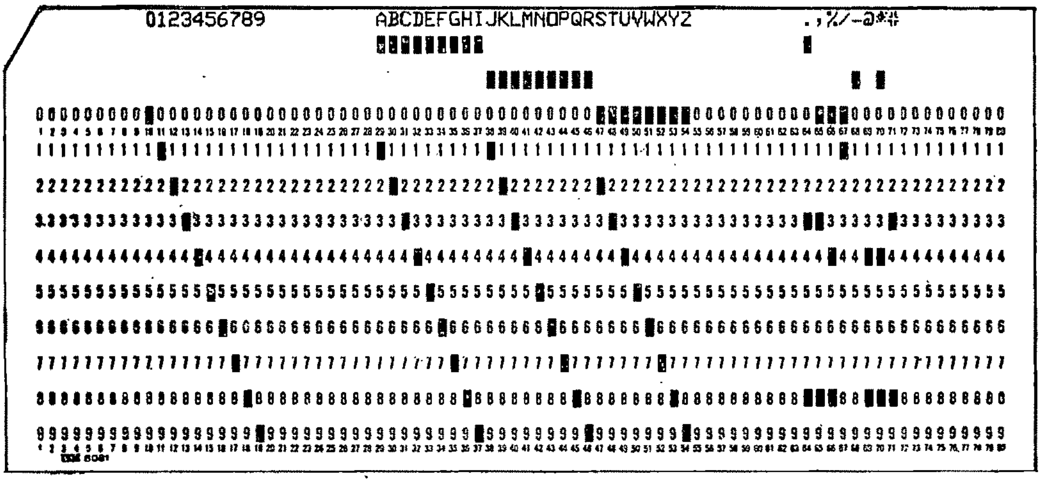

Figure 3. Card showing letters and special characters punched by IBM 029

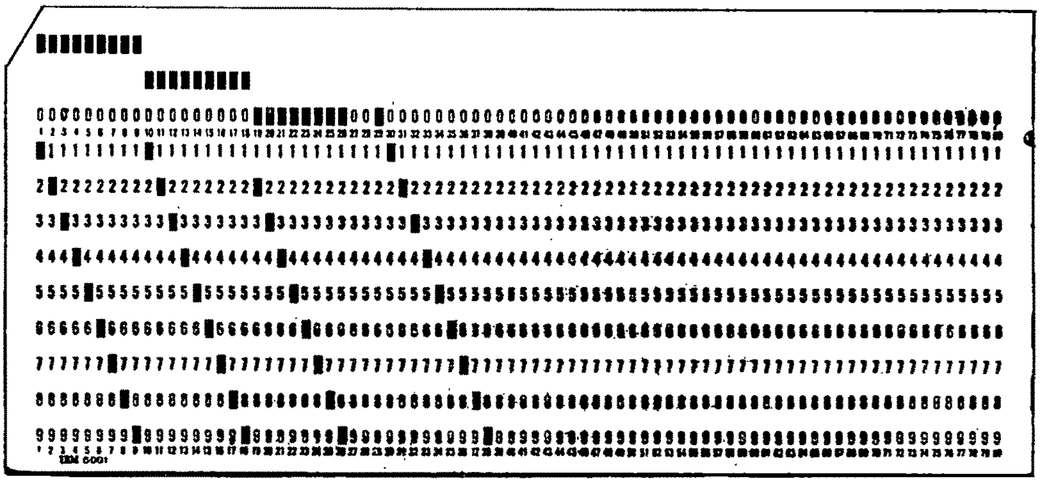

Figure 4. Showing notch cut at the right end of the card

If different or wrong key is depreseed or if wrong information is punched, a red light turns on and keyboard may get locked which indicates that an error has occured. After three unsuccessful attempts a small semicircular notch is cut at the top of the column. (See Fig. 5). This notch identifies the column in which error has occured. A new card has to be punched for correcting the error. Thus the batch of the cards cut with semicircular notch at the right end of the card becomes a permanent evidence for correct conversion of the information.

Verification is an important step in conversion phase of the information preparation. It ensures that all the information has been correctly converted into machine readable form.

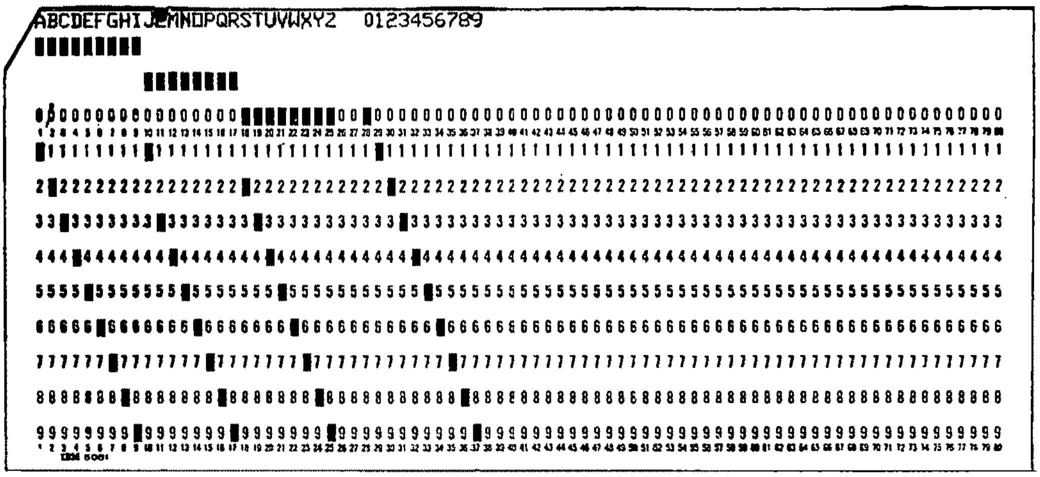

Figure 5. Showing a notch cut at the top of a column

PREPARATION OF INFORMATION

Programmed Punching and Verification

Another important feature of the punching machine is that it is provided with the programmed drum. By properly using this feature it is possible to gain speed and accuracy for punching and verification. A programme card is similar to that of punch card. The card is punched with four basic codes. It is mounted on a programme drum which is located at the top of the machine. Programme card is prepared for quick and automatic operations such as skipping, duplicating, field definition, numeric shift, and alphabetic shift. A different programme card is punched for each job in which punching and verification routine differs. A same programme card can be used repeatedly for the same punching and verification routine.

Four Basic Programme Codes

12-	Field definition
11-	Start auto skip
0-	Start auto duplication
1-	Alphabetic shift

Example

The information regarding the authors and keywords is being regularly prepared for processing the author and keyword indexes to the monthly issues of the Indian Science Abstracts. This work provides a very suitable example of information preparation work.

The information necessary for the preparation of Author Index consists of the name of the author – personal or corporate – and the serial number of abstract in which it figures. No real coding is necessary with the exception of abbreviation of long corporate names. The information preparation mainly consists of transliteration and hence there is no need for transcribing the information on the coding sheet. Conversion is done directly from the process slips and by 024 card punch and 056 verifier. In fact, one card accomodates the information pertaining to two authors. The conversion is done with the aid of a programme card. Each field for the name of author utilises 32 columns and the each entry number uses seven column (Fig. 6). Recording is done in fixed field manner.

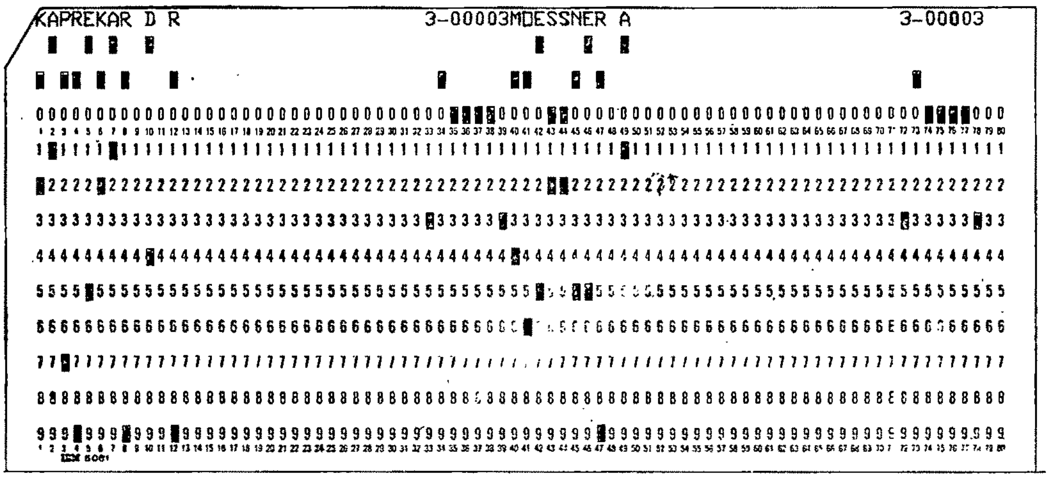

Fig. 6. Sample punched card for Author Index

Free field recording and conversion is done for the information pertaining to the keyword-index. The information necessary for this consist of an entry number, a keyword and the context. With the exception of entry number, other elements of information are of varying length. Slash '/' is used as an indicator a delimiter to indicate the termination of a keyword and the beginning of the context. The context is terminated by special symbol called record mark. (See Fig. 7). The preparation of information of this type does neither require coding nor transcription. The conversion is done from the information contained in the process slips by IBM 029 punch and 056 verifier.

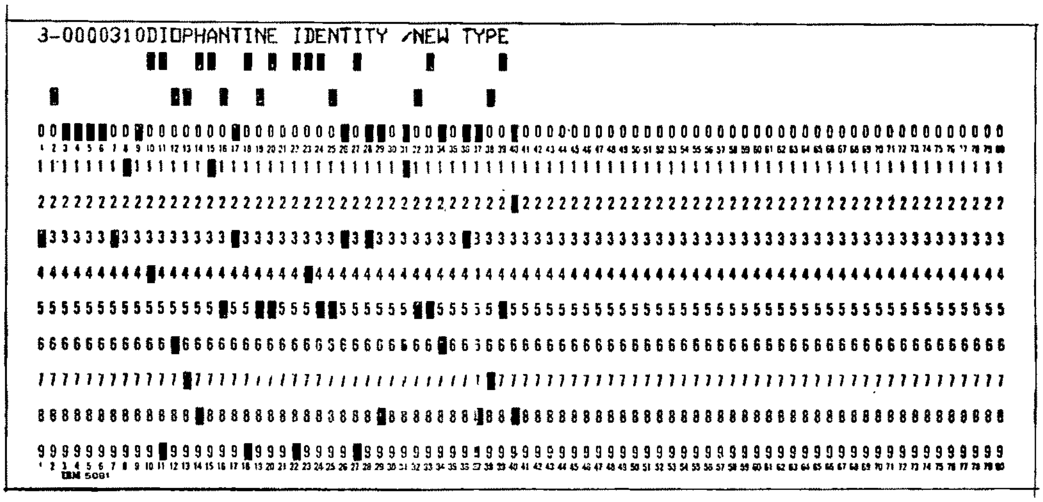

Fig. 7. Sample punched card for Keyword Index

Conclusion

The information preparation is a basic and fundamental stage of information processing work by computers. This stage consists of intellectual activity concerned with the design and development of efficient codes, manual activity comprising transcription on coding sheets whenever necessary and conversion with the aid of suitable machines. The identification of these three distinct but interdependent phases of information preparation work is likely to provide greater ease and facility for further information processing by computers.

Acknowledgements

Authors wish to record their gratitude to Director Insdoc for providing the required facility for working in a free environment.

AUTHOR INDEX TO INDIAN SCIENCE ABSTRACTS

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Describes the computer production of author index to the monthly issues of the Indian Science Abstracts. Stresses the need for an authority file for indexing work. Gives the programme adaptations to suit photo-offset printing requirements.

INTRODUCTION

The Indian Science Abstracts (ISA) which started in 1965, includes an author index with each of its monthly issues. This index was produced by conventional methods in the first volume. By the end of the first volume, it became obvious that it was not possible to produce these indexes along with individual issues without jeopardizing publication schedules. It was estimated that the annual cumulated index to volume I and the current monthly indexes would cause an inordinate production delay in either case with the existing facilities. The Projects Division, with its newly acquired facilities such as computer time, carried on successful experimentation in this direction and took over the monthly and annual processing of the author index with effect from the first issue of Volume 2. An attempt is made to describe the details of the processing of the author index by a digital computer.

CONVENTIONAL METHOD

The stages involved in the production of a hard copy of author index by the conventional method are as follows:

1. Writing of author entries on 5" x 3" cards. An entry consists of the name of the author and the serial number of the abstract in the issue of the ISA.
2. Alphabetisation of the 5" x 3" cards.
3. Consolidation of entries by merging different entries under the same author.
4. Typing of the above entries on electric typewriters.
5. Checking and correction of the typed copy.

The typed copy with all corrections incoporated is passed on to the Printing Section for page making. The laid out pages are returned to the ISA Section for final checking. Pages are laid out in four columns. Stages 1, 2, 3 and 5 involved the participation of the technical staff of the ISA.

The time required for the production of a hard copy of the index to a monthly issue of the ISA, by this method was, on the average, 96 man hours. The load on the staff of the ISA for the production of the cumulated index to the earlier volume would have been in the vicinity of 4 man months.

COMPUTER PROCESSING

Computer processing of the author index is discussed here under the heads of:

1. Preparation.
2. Standardisation.
3. Conversion.
4. Programming.

1. Preparation

By the term preparation is meant making the source material ready for conversion into machine readable form with the object of minimising errors at the time of actual conversion. The preparation is oreinted towards the machine in view, and towards an acceptable end-product as a result of machine processing. At this stage steps are taken to prevent quantitative and qualitative errors likely to occur at the conversion stage. This ensures speed at the actual conversion stage by leaving very little decision to the key punch operators.

The source material for the compilation of the author-index is the 8" x 5" process slips used by the abstractors of the ISA (Item 1 in the Appendix). Each of these slips contain full bibliographical details of the document together with the abstract. These are passed on to the Projects division in batches.

Quantitative Errors

One of the quantitative errors likely to occur at the conversion stage is that of the omission to key punch some of the entries. This is especially probable when a process slip contains the names of several contributors. In order to avoid such an error a count of the number of entries to be derived from a batch of process slips is made, which will later on be checked with the number of cards punched for that particular batch.

Cataloguing Requirements

The rendering decided upon for a personal author is the surname followed by the initials of his first name and or middle name. A space seperates the name from the initials and also seperates two or more initials. Process slips are scanned in order to detect and correct any departures from this practice. Another source of error is in the case of two worded indic names such as Subba Rao, Jagjit Singh etc. It would be improper to render these names as Rao S or Singh J. These are also corrected before being passed on to key punch operators for conversion. Illegible corrections, additions or alternations, made on the process slip are rewritten on the slip in order to avoid errors at the conversion stage.

Machine oriented requirements

Alphabetisation by computer results in a character-by-character alphabetical sequence. A space, unlike in manual alphabetisation, is also considered to be a character. This presents a problem with certain indic names such as Sen Gupta, Roy Chowdhury, Krishna Murthy etc. Such names are spelt with both components of the same separated by space, as also without a space between them. Representation of such names in the form in which they are done by the author himself would result in a scattering of similarly spelt names as a result of character-by character alphabetisation. An example of such scattering is provided by the following sequence:

SEN A K
SEN D
SEN G N
SEN GUPTA T
SEN R
SENGUPTA N

Sengupta spelt with the components together and components seperated are scattered by Sen R occuring in between as a result of machine alphabetisation. Further all the SEN's would also not be together. Such scattering would assume greater proportions in a cumulated index containing several such names. In order to avoid such scattering, a departure from the conventional method of rendering such names in the manner, as reported by the author himself, had to be done away with. Instead, it was decided to represent them uniformly without a space between the component parts. Process slips are scanned with the above limitation in view and such names are brought together by suitable indications on the slip. However, no attempt has been made to bring variant forms of the same name (e.g. Chowdhury, Choudhary etc. together). Another machine limitation is the fact that certain symbols are not available on the computer printer. One such symbol is the '&' symbol. In place of this it was decided to use the '+' symbol.

2. Standardisation

Corporate names are often long and occupy costly printing space at the output stage, and from the machine point of view, costly storage areas. It was felt that corporate names could be conveniently abbreviated in an author index without losing their information content. This would result in advantages such as: (1) less storage requirements on the machine; (2) faster computer processing as a result of smaller records; (3) economy in conversion; (4) compatibility, with the use of punched cards as input to the computer. It is easier to handle information on cards when a whole unit of information can be accomodated on one card or part of it, rather than when it overflows into two or more cards.

With the above considerations in view, it was decided to abbreviate corporate names. In abbreviating such names the rules followed were: (1) the first word of a name was in most cases not abbreviated at all. This would ensure that the abbreviated name would occur in about the same place in the alphabetical sequence as it would if it were not abbreviated; (2) commonly occuring terms such as 'research', 'industry', 'institute' etc. were abbreviated following, generally, the abbreviations suggested by the World List of Scientific Periodicals. Other terms such as 'Company', 'Limited', 'Aktiengesellschaft', 'Gesellschaft mit Beschrankter Haftung' have been abbreviated according to the common practice followed (e.g. Co., Ltd., AG, GMBH); (3) articles, prepositions conjunctions are omitted in most cases; (4) corporate names beginning with the initials of a personal name (e.g. J.R. Geigy) are given two entries, one with the name as occuring in the document and another with the inverted form (Geigy (JR)....). This will ensure that the entry will not be missed with either of the approaches to the index.

Authority file

The production of the index to a monthly issue is followed by the merger of the current month's file with files for the previous months. This way, the index is continuously cumulated, so that no re-sorting of records is necessary in order to produce the cumulated annual index. In order that this may be done, it is necessary that there should be no discrepancy in the names from one issue to another. For instance, the corporate name 'General Electric Company Limited' abbreviated as 'General Electric Co., Ltd', in one issue and as 'General Electric Co.', in another would result in two entries in the cumulated index, one under each of the above names.

In order to ensure consistency in abbreviating corporate names, an authority file on 2" x 3" cards has been developed. This file contains the full name of the corporate body and the abbreviation to be followed at the time of conversion. It also contains instructions as to the number of entries to be derived from a given name when more than one is to be derived. The file is consulted, when necessary, by key punch operators at the time of conversion.

3. Conversion

The input media is the 80 column general purpose IBM punched card. The automatic card punch (Model 024 of IBM) and Verifier (Model 056 of IBM) are the tools used in converting source material into machine readable form.

Field Allocation

The fields allocated for information on authors is as follows:

Cols.	Data
1-32	Name of author
33-34	Volume No.
35-39	Serial No. of the entry in the issue of ISA
40-71	Name of author
72-73	Volume No.
74-78	Serial No. of the entry in the issue of ISA.

It can be seen from the above allocation that two entries can be punched on one card. A sample data card is reproduced as item 2 in the Appendix.

Key-punching and verification

A batch of process slips with the necessary corrections etc. carried out on them is passed on to the key punch operators. Here it is key punched and verified. These operations are performed by two different operators. The authority file is consulted when the need to abbreviate arises. Cases where abbreviations have not yet been provided are brought to notice. New abbreviations are then merged into the authority file, keeping it up-to-date.

The punched and verified cards for a given batch are then counted using an IBM 082 sorter. This count is then tallied with the manual count made before the batch was passed on for key punching. The card file is now ready for further processing on the computer.

4. Programming

The computer used in the processing of the author index is the IBM 1620 (Model II). The peripherals available on the system used are a 1622 card Read/Punch, three 1311 Magnetic Disk Drives and a 1443 Line Printer. The system accepts programmes in Fortran IID and Symbolic Programming Systems language (SPS-IID) for the 1620.

The Programmes necessary to produce the hard copy of the author index are discussed herein under:

i) Storage Programme;
ii) Alphabetisation; and
iii) Edited output.

Storage Programme:

The object of this programme is to store the author information on punched cards on the magnetic disk. This is necessary since (1) the volume of author information cannot be accómodated in full in the active memory of the computer, and (2) the data pertaining to each monthly issue is to be used at the time of cumulation.

The programme reads the cards, separates the two author records found on each card and stores each of them on the disk as one sector records.

The average reading time of this programme is 500 cards per minute. Storage of the author information pertaining to a monthly issue of the ISA takes about two minutes. The flow chart of this programme is presented as item 5. A portion of its listing is presented as item 3 in the Appendix. The programme was written in the SPD-IID language.

Alphabetisation

Alphabetisation on the computer is accomplished by sequencing the records into an ascending order. This is possible since internally the character 'A' has a value lesser than that of 'B', 'B' lesser than that of 'C' and so on.

The programme used for this purpose is a general purpose sort-merge programme viz. the 'Sort-Merge 047' developed by the IBM specially for the IBM 1620. This programme is capable of sorting and/or merging one or two files at a time. The files may either be on punched cards, paper tape or magnetic disk and may contain numeric or alphameric data. The programme operates on control records fed to it, describing the type of file, disk locations of the file, the size and type of records, the area on disk where alphabetised records are to be put and the extent to which the storing is desired. In processing the author index, this programme was used to put into an alphabetical sequence the author information pertaining to a monthly issue of the ISA. The average time required for alphabetising author entries for a monthly issue is about 9 minutes. The alphabetised file on disk is now available for the next operation viz. output.

Edited Output

The object of this programme was to print on the 1443 printer the author index with the following constrants in view:

(A) The width of a column of the index was never to exceed 25 characters. It was found that with this column width, it was possible to accommodate after suitable reduction, for columns per page.

(B) The name of an author contributing more than one article was to figure only once. Multiple contributions were to be indicated only by the serial numbers of the abstracts on the second and subsequent lines. Continuation was to be indicated by an indention.

(C) When the name of an author exceeded 20 characters, it had to be continued on the seond line. (This would be the case with most corporate names). The continued line was to begin as far as possible with a new word. When a word had to be broken up on account of the limitation of the column width the break had to be intelligible (i.e. at least a few words occuring before and after the break).

(D) The column was to be right justified.

The output is in the form of a single column index. This is later on laid out in four columns per page, reduced and photo-offset printed. A sample of the printed page is presented as item 7 (p. 19). The programme was originally written in Fortran IID using a SPS subroutine. Subsequently it was rewritten only in SPS resulting in a much faster programme, cutting the output time by two thirds. The average time taken to output a monthly index was about 7 minutes. The flow chart of this programme is presented as item 6 in the Appendix. A portion of the listing is presented as item 4 in the Appendix.

CONCLUSION

The time required to process the author index to a monthly issue of the ISA is as follows:

Conversion Time:

Punching and Verification: 18 Man hr.

Computer Time:

Storage:	2 minutes
Alphabetisation:	9 minutes
Listing:	7 minutes
Total:	18 minutes

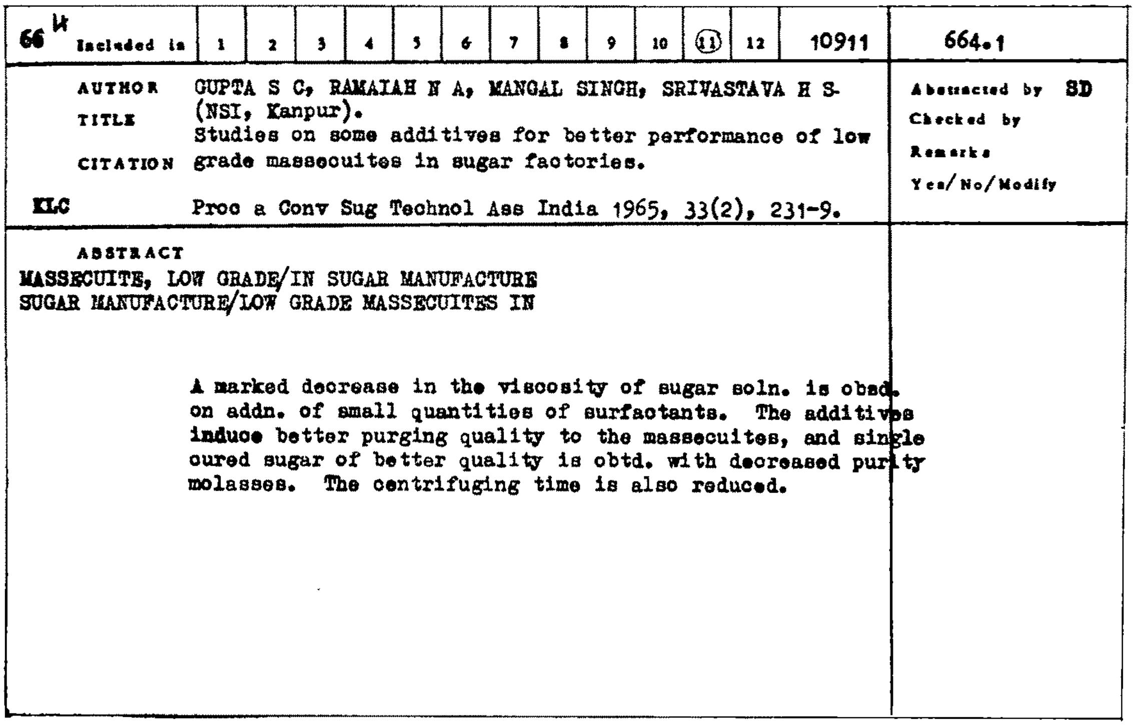
AUTHOR INDEX TO ISA

The programmes developed by the Projects Division for the processing of the author index are being utilised for the routine production of monthly author indexes to the ISA.

ACKNOWLEDGEMENTS

We are thankful to Shri B.S. Kesavan, Director Insdoc for providing us the facilities for this experimentation.

APPENDIX



66 Ik Included in 1 2 3 4 5 6 7 8 9 10 (11) 12 10911 664.1

AUTHOR GUPTA S C, RAMAIAH N A, MANGAL SINGH, SRIVASTAVA H S-
TITLE (NSI, Kanpur).
Studies on some additives for better performance of low
CITATION grade massecuites in sugar factories.

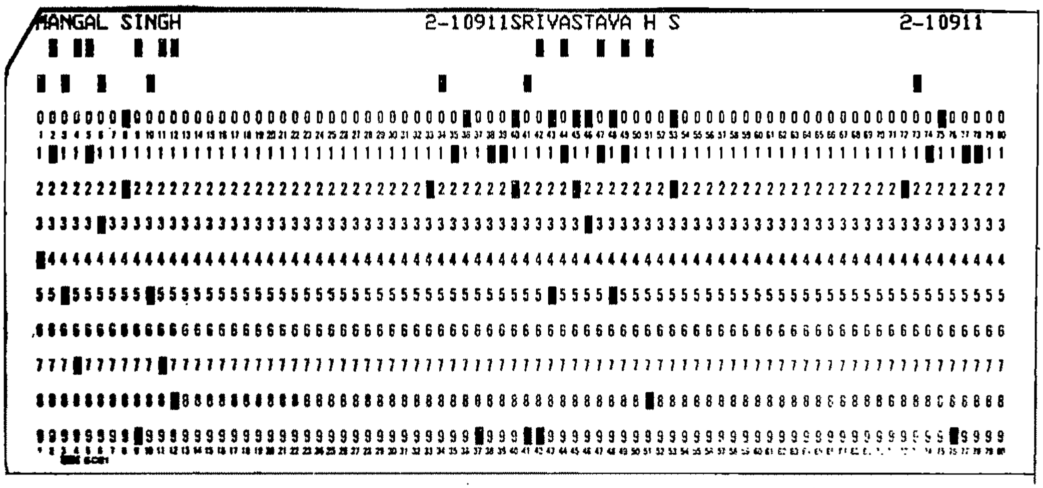
KLC Proc a Conv Sug Technol Ass India 1965, 33(2), 231-9.

Abstracted by SD
Checked by
Remarks
Yes/No/Modify

ABSTRACT
MASSECUITE, LOW GRADE/IN SUGAR MANUFACTURE
SUGAR MANUFACTURE/LOW GRADE MASSECUITES IN

A marked decrease in the viscosity of sugar soln. is obsd. on addn. of small quantities of surfactants. The additives induce better purging quality to the massecuites, and single cured sugar of better quality is obtd. with decreased purity molasses. The centrifuging time is also reduced.

1. A sample process slip



2. A sample card showing two author entries punched on the same card.

```
*NAME AINPUT
*STORE RELOADABLE
*ASSEMBLE RELOCATABLE
     * INPUT PROGRAMME FOR CARDS WITH TWO
     * AUTHORS PER CARD.THE AREA FROM 2402
     *TO 4000IS CLEARED OF FLAGS AND AFTER
     *THIS INITIALIZATION THE REST OF THE
     *PROGRAMME IS LOADED AND EXECUTED
     SPACESDC  50,0
     RECKNTDC  5,0
     KNTR  DC  5,0
     KOUNT DC  3,0
     AREA  DAS 100
     CARD  DAS 80
     DCF   DDA ,0,0,2,AREA-1
     START RNCDCARD-1
           SF  CARD-1
           TF  DCF+5,CARD+4
           MF  DCF+1,DCF
           SF  CARD+5
           TF  RECKNT,CARD+9
     CF    CF  CARD,,2
           AM  CF+6,1
           AM  KOUNT,1,9
           CM  KOUNT,159,9
           BL  CF
           TFM KOUNT,0,9
           TFM CF+6,CARD
     BEGIN RACDCARD
           SF  CARD-1
           SF  CARD+77
           TF  AREA+198,SPACES
           TF  AREA+148,SPACES
           TF  AREA+93,SPACES
           TF  AREA+48,SPACES
           TF  AREA+76,CARD+76
           TF  AREA+176,CARD+154
     CFLAG CF  AREA-1,,2
           AM  CFLAG+6,1
           AM  KOUNT,1,9
           CM  KOUNT,200,9
           BL  CFLAG
           TFM CFLAG+6,AREA-1
           TFM KOUNT,0,9
           BD  STORE,DCF+5
           BD  STORE,DCF+4
           SK  DCF
     STORE WDN DCF
           CDN DCF
           AM  DCF+5,2
           AM  KNTR,1
           C   KNTR,RECKNT
           BL  BEGIN
           BH  HALT
           TF  AREA+198,SPACES
           TF  AREA+148,SPACES
           TF  AREA+98,SPACES
           TF  AREA+48,SPACES
           RNCDAREA-1
           B7  CFLAG
     HALT  CALLEXIT
           DENDSTART
```

3. Listing of Input programme

```
*NAME AINDEX
*STORE RELOADABLE
   *FOUR COLUMN AUTHOR INDEX
   *CARD CONTAINS 6 DIGIT STARTING SECTOR
   *ADDRESS AND 5 DIGIT RECORD KOUNT
001INDEX DSA 0
002KOUNT DC  2,0
010COUNT DC  5,0
011NONE  DAS 50
012NTWO  DAS 50
013NEWS  DAS 40
014      DC  4,0
015LSTOR DSB 12,4
016      DAC 1,@
017RECKNTDC  5,0
018COMMA DC  2,23
019RECMK DAC 1,@
020BLANK DC  2,0
021HYPHENDC  4,200@
022DCF   DDA ,0,0,1,NONE-1
023DCF1  DDA ,0,0,1,NTWO-1
024ZEROS DC  12,0
025DIGIT DC  2,0
026SPACESDC  48,0
027BLANKSDC  4,0
028SWITCHDC  2,0
029SW    DC  2,0
031BUFR  DAS 20
032BUFR1 DAS 25
033      DAC 1,@
034START RNCDNONE-1
035      SF  NONE-1
036      TF  DCF+5,NONE+4
037      MF  DCF+1,DCF
038      SF  NONE+5
039      TF  RECKNT,NONE+9
040      AM  NONE+4,1
041      TF  DCF1+5,NONE+4
042      MF  DCF1+1,DCF1
043      TF  LSTOR+36,SPACES
044      SF  NEWS-1
045      TF  NEWS+62,SPACES
046      TF  NEWS+15,ZEROS
047      TF  NEWS+5,BLANKS
047      TF  NEWS+2,BLANKS
048      SK  DCF
049      RDN DCF
050      SF  NONE-1
051      TF  NONE+78,RECMK
052      RDN DCF1
053      TF  NTWO+78,RECMK
054      B7  COMP
055      SPIM,3
056START1TR  NONE-1,NTWO-1
057      AM  DCF1+5,1
058      BD  READ1,DCF1+5
059      BD  READ1,DCF1+4
060      TD  DIGIT,DCF1+3
061      MM  DIGIT,5,10
061      BD  READ1,99
062      SK  DCF1
063READ1 RDN DCF1
064      TF  NTWO+78,RECMK
065COMP  SF  NTWO-1
066      C   NONE,NTWO
```

```
067      BNE NUALFA
068      C   NONE+62,NTWO+62
069      BNE TEST1
070      BD  SECOND,LSTOR
071      C   NTWO+62,NEWS+62
072      BNE PTEST-12
073      B7  FIRST+12
074      TFM SW,0,10
075PTEST SF  NONE+37
076      C   NONE+48,ZEROS
077      BE  PRINT
078      BTM TESTER,0
079TRY   AM  COUNT,1
080      C   COUNT,RECKNT
081      BE  HALT
082      CM  SW,1,10
083      BE  NEW
084      BL  FIRST
086      TFM SW,0,10
087      B7  START1
088NEW   TFM SW,0,10
089      B7  START1-12
090PRINT TF  BUFR1+48,SPACES
091      SF  NONE+67
092      TF  BUFR1+48,NONE+76
093      TF  NONE+38,RECMK
094      TRNMBUFR1-1,NONE-1
095      PRA BUFR1
094      BNI TRY,3400
095      SKIP,1
096      B7  TRY
100FIRST BD  SECOND,LSTOR
101      SF  NTWO+67
102      TF  LSTOR-2,NTWO+76
103      TF  LSTOR,COMMA
104      CF  NTWO+67
105      B7  START1
106SECONDBD  THIRD,LSTOR+12
107      SF  NTWO+67
108      TF  LSTOR+10,NTWO+76
109      TF  LSTOR+12,COMMA
110      CF  NTWO+67
111      B7  START1
112THIRD BD  FOURTH,LSTOR+24
113      SF  NTWO+67
114      TF  LSTOR+22,NTWO+76
115      TF  LSTOR+24,COMMA
116      CF  NTWO+67
117      B7  START1
118FOURTHSF  NTWO+67
119      TF  LSTOR+34,NTWO+76
120      CF  NTWO+67
120      TF  LSTOR-12,BLANKS
121      PRA LSTOR-14
122      AM  COUNT,4
123      TFM SWITCH,1,10
124DUCKS TF  LSTOR+36,SPACES
125      CM  SWITCH,1,10
126      BE  CF
127      B7  TRY+12
128CF    CF  NONE,,2
129      AM  CF+6,1
130      AM  KOUNT,1,10
131      CM  KOUNT%63,10
132      BL  CF
```

4. Listing of Edited Output programme [Continued]

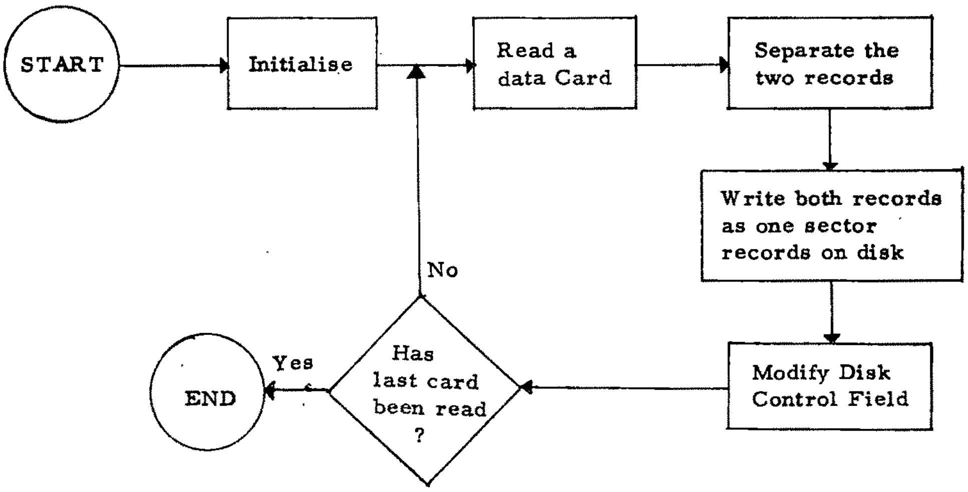
```
133      TFM CF+6,NONE
134      TFM KOUNT,0,10
135      SF  NONE-1
136      TR  NEWS-1,NONE-1
137      TFM SW,2,10
139      B7  TRY+12
140NUALFATFM SW,1,10
144      BD  MTSTOR,LSTOR
145      C   NEWS+62,NONE+62
146      BNE PTEST
147      B7  START1
148MTSTORTFM SWITCH,0,10
148      TF  LSTOR-12,BLANKS
149      BD  MT,LSTOR+33
150ONE   BD  DCOMA1,LSTOR+24,7
151TWO   BD  DCOMA2,LSTOR+12,7
152      TF  LSTOR,BLANK
153      AM  COUNT,1
153      B7  MT
154DCOMA1TF  -ONE-11,BLANK
154      AM  COUNT,3
155      B7  MT
156DCOMA2TF  -TWO-11,BLANK
157      AM  COUNT,2
157MT    PRA LSTOR-14
160      B7  DUCKS
160TEST1 TFM SW,2,10
161      BD  MTSTOR,LSTOR
163      C   NEWS+62,NONE+62
164      BNE PTEST
165      B7  START1
166HALT  BNC1*+20
166      B7  20448
166      CALLEXIT
167      DC  5,0
168TESTERC   BLANK,NONE+38
169      BE  TYPE1
170      SF  NONE+35
171      C   BLANK,NONE+36
172      BE  TYPE2
173      SF  NONE+33
174      C   BLANK,NONE+34
175      BE  TYPE3
176      SF  NONE+31
177      C   BLANK,NONE+32
178      BE  TYPE4
179      SF  NONE+29
180      C   BLANK,NONE+30
180      BE  TYPE5
181CFLAG CF  NONE,,2
182      AM  CFLAG+6,1
183      AM  KOUNT,1,10
184      CM  KOUNT,63,10
185      BL  CFLAG
186      TFM CFLAG+6,NONE
187      TFM KOUNT,0,10
188      TF  BUFR+32,NONE+32
189      TF  BUFR+36,HYPHEN
190      PRA BUFR
191      TFM INDEX,*+24
192      B   NUPAGE
193      SF  NONE+33
194      SF  NONE+67
195      TF  BUFR1+48,SPACES
195      TF  BUFR1+48,NONE+76
```

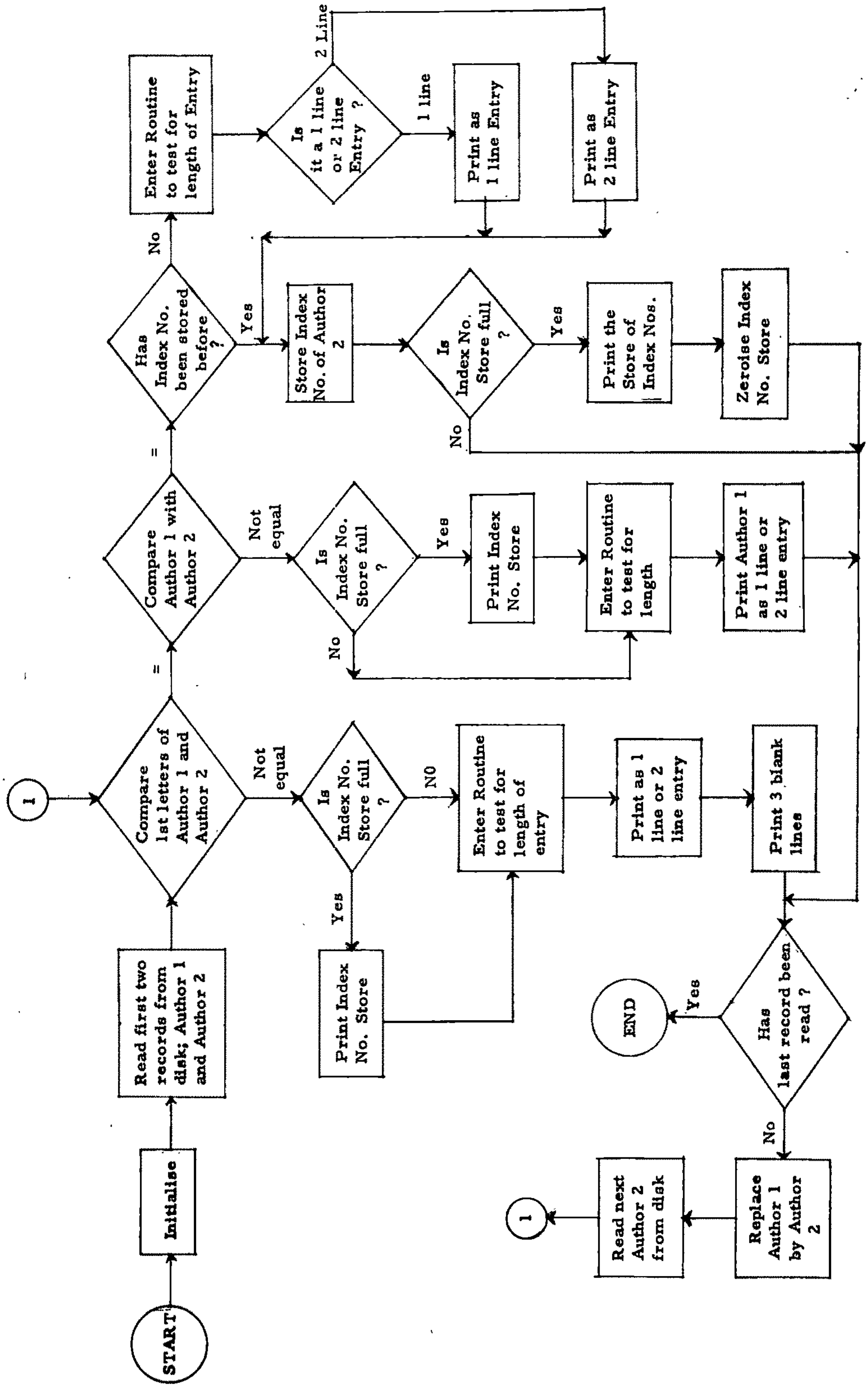
```
197      TF  NONE+64,RECMK
198      TRNMBUFR1+3,NONE+33
199      TF  BUFR1+2,BLANKS
200      PRA BUFR1
201      B7  NPAGE
202TYPE1 TF  BUFR+36,NONE+36
203      TF  BUFR+38,RECMK
204      PRA BUFR
205      TFM INDEX,*+24
206      B   NUPAGE
207      SF  NONE+39
208      SF  NONE+67
209      TF  BUFR1+48,SPACES
210      TF  BUFR1+48,NONE+76
220      TF  NONE+64,RECMK
230      TRNMBUFR1+3,NONE+39
240      TF  BUFR1+2,BLANKS
250      PRA BUFR1
260      B7  NPAGE
270TYPE2 TF  BUFR+34,NONE+34
271      TF  BUFR+36,RECMK
272      PRA BUFR
273      TFM INDEX,*+24
274      B   NUPAGE
275      SF  NONE+37
276      SF  NONE+67
277      TF  BUFR1+48,SPACES
278      TF  BUFR1+48,NONE+76
279      TF  NONE+64,RECMK
280      TRNMBUFR1+3,NONE+37
281      TF  BUFR1+2,BLANKS
282      PRA BUFR1
283      B7  NPAGE
284TYPE3 TF  BUFR+32,NONE+32
285      TF  BUFR+34,RECMK
286      PRA BUFR
287      TFM INDEX,*+24
288      B   NUPAGE
289      SF  NONE+35
290      SF  NONE+67
291      TF  BUFR1+48,SPACES
292      TF  BUFR1+48,NONE+76
293      TF  NONE+64,RECMK
294      TRNMBUFR1+3,NONE+35
295      TF  BUFR1+2,BLANKS
296      PRA BUFR1
297      B7  NPAGE
298TYPE4 TF  BUFR+30,NONE+30
399      TF  BUFR+32,RECMK
300      PRA BUFR
301      TFM INDEX,*+24
302      B   NUPAGE
303      SF  NONE+33
304      SF  NONE+67
305      TF  BUFR1+48,SPACES
306      TF  BUFR1+48,NONE+76
307      TF  NONE+64,RECMK
308      TRNMBUFR1+3,NONE+33
309      TF  BUFR1+2,BLANKS
310      PRA BUFR1
311      B7  NPAGE
312TYPE5 TF  BUFR+28,NONE+28
313      TF  BUFR+30,RECMK
314      PRA BUFR
315      TFM INDEX,*+24
```

[Continued]

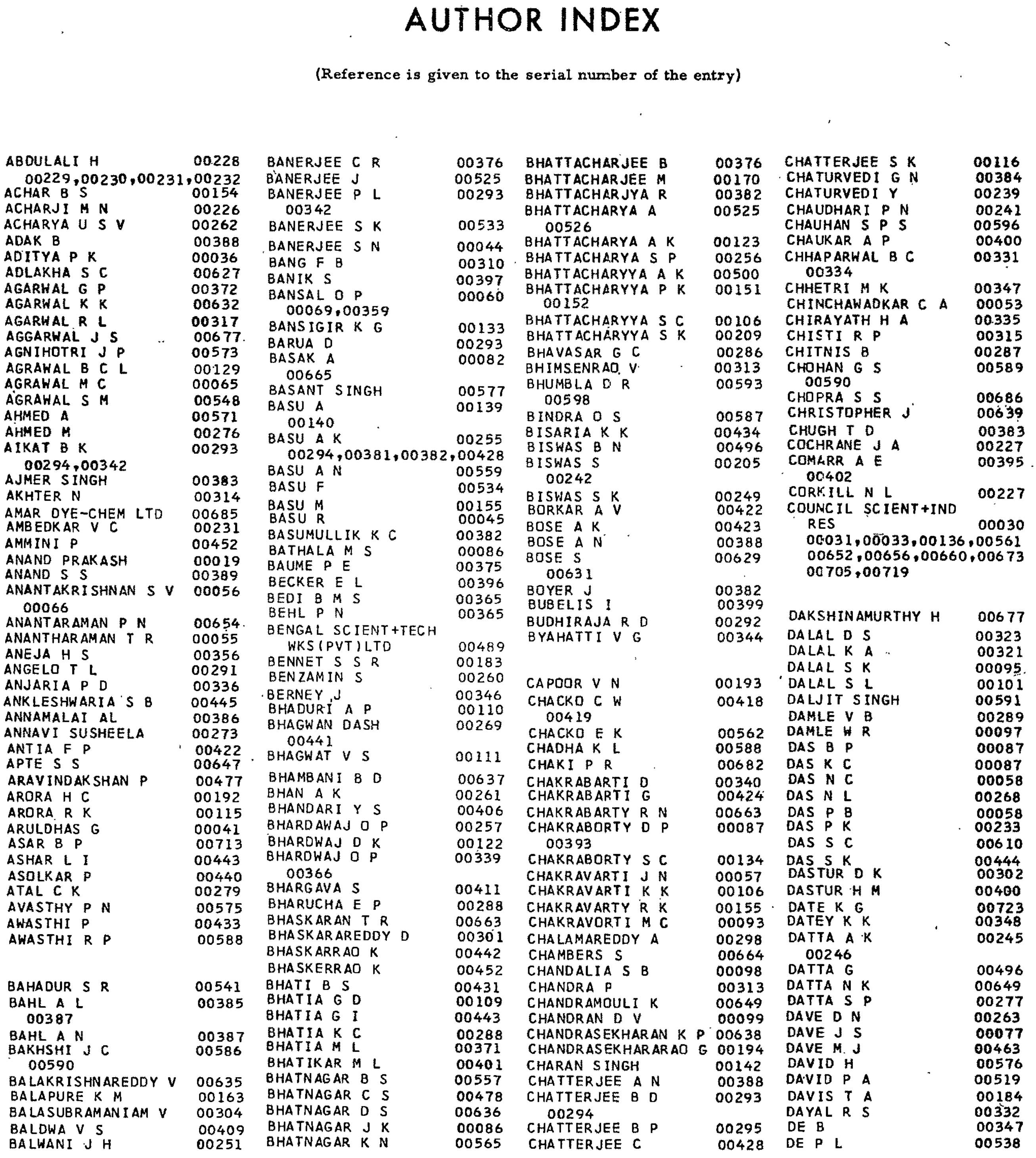
```
316      B    NUPAGE
317      SF   NONE+31
318      SF   NONE+67
319      TF   BUFR1+48,SPACES
320      TF   BUFR1+48,NONE+76
321      TF   NONE+64,RECMK
322      TRNMBUFR1+3,NONE+31
323      TF   BUFR1+2,BLANKS
324      PRA  BUFR1
325           B7   NPAGE
327NUPAGEBNI  -INDEX,3400
328           SKIP,1
329           B    -INDEX
330NPAGE BNI  BB,3400
328           SKIP,1
332BB         BB
333           DENDSTART
```

5. Flow Chart: Input programme [Author Index]


START
Initialise
Read a data Card
Separate the two records
Write both records as one sector records on disk
Modify Disk Control Field
Has last card been read ?
No
Yes
END


START
Initialise
Read first two records from disk; Author 1 and Author 2
1
Compare 1st letters of Author 1 and Author 2
=
Not equal
Is Index No. Store full ?
Yes
Print Index No. Store
NO
Enter Routine to test for length of entry
Print as 1 line or 2 line entry
Print 3 blank lines
Compare Author 1 with Author 2
=
Not equal
Is Index No. Store full ?
Yes
Print Index No. Store
No
Enter Routine to test for length
Print Author 1 as 1 line or 2 line entry
Has Index No. been stored before ?
No
Enter Routine to test for length of Entry
Is it a 1 line or 2 line Entry ?
1 line
2 Line
Print as 1 line Entry
Print as 2 line Entry
Yes
Store Index No. of Author 2
Is Index No. Store full ?
Yes
Print the Store of Index Nos.
Zeroise Index No. Store
No
Has last record been read ?
Yes
END
No
Replace Author 1 by Author 2
Read next Author 2 from disk
1

6. Flow Chart: Edited output programme



AUTHOR INDEX

(Reference is given to the serial number of the entry)

ABDULALI H	00228 00229,00230,00231,00232
ACHAR B S	00154
ACHARJI M N	00226
ACHARYA U S V	00262
ADAK B	00388
ADITYA P K	00036
ADLAKHA S C	00627
AGARWAL G P	00372
AGARWAL K K	00632
AGARWAL R L	00317
AGGARWAL J S	00677
AGNIHOTRI J P	00573
AGRAWAL B C L	00129
AGRAWAL M C	00065
AGRAWAL S M	00548
AHMED A	00571
AHMED M	00276
AIKAT B K	00293 00294,00342
AJMER SINGH	00383
AKHTER N	00314
AMAR DYE-CHEM LTD	00685
AMBEDKAR V C	00231
AMMINI P	00452
ANAND PRAKASH	00019
ANAND S S	00389
ANANTAKRISHNAN S V	00056 00066
ANANTARAMAN P N	00654
ANANTHARAMAN T R	00055
ANEJA H S	00356
ANGELO T L	00291
ANJARIA P D	00336
ANKLESHWARIA S B	00445
ANNAMALAI AL	00386
ANNAVI SUSHEELA	00273
ANTIA F P	00422
APTE S S	00647
ARAVINDAKSHAN P	00477
ARORA H C	00192
ARORA R K	00115
ARULDHAS G	00041
ASAR B P	00713
ASHAR L I	00443
ASOLKAR P	00440
ATAL C K	00279
AVASTHY P N	00575
AWASTHI P	00433
AWASTHI R P	00588
BAHADUR S R	00541
BAHL A L	00385 00387
BAHL A N	00387
BAKHSHI J C	00586 00590
BALAKRISHNAREDDY V	00635
BALAPURE K M	00163
BALASUBRAMANIAM V	00304
BALDWA V S	00409
BALWANI J H	00251
BANERJEE C R	00376
BANERJEE J	00525
BANERJEE P L	00293 00342
BANERJEE S K	00533
BANERJEE S N	00044
BANG F B	00310
BANIK S	00397
BANSAL O P	00060 00069,00359
BANSIGIR K G	00133
BARUA D	00293
BASAK A	00082 00665
BASANT SINGH	00577
BASU A	00139 00140
BASU A K	00255 00294,00381,00382,00428
BASU A N	00559
BASU F	00534
BASU M	00155
BASU R	00045
BASUMULLIK K C	00382
BATHALA M S	00086
BAUME P E	00375
BECKER E L	00396
BEDI B M S	00365
BEHL P N	00365
BENGAL SCIENT+TECH WKS(PVT)LTD	00489
BENNET S S R	00183
BENZAMIN S	00260
BERNEY J	00346
BHADURI A P	00110
BHAGWAN DASH	00269 00441
BHAGWAT V S	00111
BHAMBANI B D	00637
BHAN A K	00261
BHANDARI Y S	00406
BHARDAWAJ O P	00257
BHARDWAJ D K	00122
BHARDWAJ O P	00339 00366
BHARGAVA S	00411
BHARUCHA E P	00288
BHASKARAN T R	00663
BHASKARAREDDY D	00301
BHASKARRAO K	00442
BHASKERRAO K	00452
BHATI B S	00431
BHATIA G D	00109
BHATIA G I	00443
BHATIA K C	00288
BHATIA M L	00371
BHATIKAR M L	00401
BHATNAGAR B S	00557
BHATNAGAR C S	00478
BHATNAGAR D S	00636
BHATNAGAR J K	00086
BHATNAGAR K N	00565
BHATTACHARJEE B	00376
BHATTACHARJEE M	00170
BHATTACHARJYA R	00382
BHATTACHARYA A	00525 00526
BHATTACHARYA A K	00123
BHATTACHARYA S P	00256
BHATTACHARYYA A K	00500
BHATTACHARYYA P K	00151 00152
BHATTACHARYYA S C	00106
BHATTACHARYYA S K	00209
BHAVASAR G C	00286
BHIMSENRAO V	00313
BHUMBLA D R	00593 00598
BINDRA O S	00587
BISARIA K K	00434
BISWAS B N	00496
BISWAS S	00205 00242
BISWAS S K	00249
BORKAR A V	00422
BOSE A K	00423
BOSE A N	00388
BOSE S	00629 00631
BOYER J	00382
BUBELIS I	00399
BUDHIRAJA R D	00292
BYAHATTI V G	00344
CAPOOR V N	00193
CHACKO C W	00418 00419
CHACKO E K	00562
CHADHA K L	00588
CHAKI P R	00682
CHAKRABARTI D	00340
CHAKRABARTI G	00424
CHAKRABARTY R N	00663
CHAKRABORTY D P	00087 00393
CHAKRABORTY S C	00134
CHAKRAVARTI J N	00057
CHAKRAVARTI K K	00106
CHAKRAVARTY R K	00155
CHAKRAVORTI M C	00093
CHALAMAREDDY A	00298
CHAMBERS S	00664
CHANDALIA S B	00098
CHANDRA P	00313
CHANDRAMOULI K	00649
CHANDRAN D V	00099
CHANDRASEKHARAN K P	00638
CHANDRASEKHARARAO G	00194
CHARAN SINGH	00142
CHATTERJEE A N	00388
CHATTERJEE B D	00293 00294
CHATTERJEE B P	00295
CHATTERJEE C	00428
CHATTERJEE S K	00116
CHATURVEDI G N	00384
CHATURVEDI Y	00239
CHAUDHARI P N	00241
CHAUHAN S P S	00596
CHAUKAR A P	00400
CHHAPARWAL B C	00331 00334
CHHETRI M K	00347
CHINCHAWADKAR C A	00053
CHIRAYATH H A	00335
CHISTI R P	00315
CHITNIS B	00287
CHOHAN G S	00589 00590
CHOPRA S S	00686
CHRISTOPHER J	00639
CHUGH T D	00383
COCHRANE J A	00227
COMARR A E	00395 00402
CORKILL N L	00227
COUNCIL SCIENT+IND RES	00030 00031,00033,00136,00561 00652,00656,00660,00673 00705,00719
DAKSHINAMURTHY H	00677
DALAL D S	00323
DALAL K A	00321
DALAL S K	00095
DALAL S L	00101
DALJIT SINGH	00591
DAMLE V B	00289
DAMLE W R	00097
DAS B P	00087
DAS K C	00087
DAS N C	00058
DAS N L	00268
DAS P B	00058
DAS P K	00233
DAS S C	00610
DAS S K	00444
DASTUR D K	00302
DASTUR H M	00400
DATE K G	00723
DATEY K K	00348
DATTA A K	00245 00246
DATTA G	00496
DATTA N K	00649
DATTA S P	00277
DAVE D N	00263
DAVE J S	00077
DAVE M J	00463
DAVID H	00576
DAVID P A	00519
DAVIS T A	00184
DAYAL R S	00332
DE B	00347
DE P L	00538

7. A sample page of the Author Index

KEYWORD INDEX TO INDIAN SCIENCE ABSTRACTS

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Describes the computerised processing of the Keyword Index to the monthly issues of the Indian Science Abstracts. The starting point in this process is the selected index terms along with their respective contexts. Discusses some coding and programming problems. Presents a sample listing of the index.

INTRODUCTION

Indexes are main retrieval tools to any documentation list or publication. Author and subject indexes have come to be accepted as necessary parts of bibliographical publications, such as the abstracting periodicals. The need for subject indexes to such periodicals has arisen out of the volume of literature abstracted and hence to the need for guides to the searching of literature. Such indexes may take several forms, such as keyword indexes, formula indexes, taxonomic indexes, etc. The concept of keywords and uniterms has given rise to a variety of indexes varying from one another in the extent to which they control the vocabulary used in indexing, and in the methods by which they seek to control 'noise' in retrieval. Indexes to bibliographical publications like the abstracting periodical have thrived on the keyword concept. Most abstracting periodicals provide keyword indexes of one form or the other. In the case of abstracting periodicals, the need to compile these indexes and publish them along the substantive part of these publications, viz. the abstracts has posed a serious threat to publication schedules. Further, there is the need to publish cumulated indexes at periodic intervals.

In order to produce these indexes speedily, techniques using the punched card and computer have been increasingly resorted to in the last decade. This is on account of the fact that the routines involved in such production are eminently amenable to mechanisation. Even in this two distinct levels of attempts are discernible: (1) merely to use the computer to automate the mechanics of compilation and printing of the hard copy of an index; and (2) to use the computer as an aid in arriving at and printing term or words considered as suitable indexing material. The present article is an attempt to describe how the keyword index to the Indian Science Abstracts (ISA) has been produced using computer facilities available to the Projects Cell of Insdoc. Here we are only concerned with the mechanics of index production.

Conventional Method

The keyword index to the Indian Science Abstract is based on the titles of documents abstracted. Abstractors of the ISA provide the indexing terms together with the context. The average number of entries per abstract is about 3 to 5. The keywords are indicated on the 5" x 3" process slips used by the abstractors (item 1 in the Appendix)

The stages involved in the production of a hard copy of the index by the conventional method are as follows:

1. Writing of keyword index entries on 5" x 3" cards. An entry consists of the keyword, which is the filing element, the context and an index number which is the serial number of the abstract.
2. Alphabetisation of the 5" x 3" cards.
3. Consolidation and merging of entries under the same keyword.
4. Special editorial work, such as underlining of taxonomic names.
5. Typing of entries on electric typewriters.
6. Checking and correcting of the typed copy and carrying out of corrections.

The final typed copy is then passed on to the Printing Section for column making and page layout. Pages are laid out in three columns per page. Laid out pages are returned to the ISA section for final checking before the printing by photo-offset method starts.

The average time taken to produce the typed copy of the index was of the order of 100 man hours for a monthly issue containing about 1000 abstracts. Production of the cumulated index to the earlier volume, it was estimated, would take about 800 man hours.

Computer Processing

This is discussed under the heads of: (1) Conversion; and (2) Programming.

Conversion

By conversion is meant all the process that culminate in the production of a machine readable data record, in our case a punched card.

Preparation for conversion

If computer processing is to avoid the multiple checking and correction that is involved in the conventional method, it is important to see that the punch operators are given clear copy as source for conversion into machine readable records. In order to ensure this, instructions were given to ISA typists to type the keywords and their contexts in capital letters. The keyword was separated from the context by the symbol "/". Since the typed process slips had been checked by editors of the ISA, mistakes in spelling of words were presumably limited to a minimum.

Card Design

The layout of the card for the purpose of consistent and systematic recording of data was as follows:

Cols	Data
1-2	Vol. No.
3-7	Five digital serial No. of the abstract
8	One digit (1 to 9) indicating the entry number within a given abstract. Thus if there were three entries in an abstract the first would have 1, the second 2 and third 3 in this column. It was presumed that indexing depth would never exceed 9 per abstract.
9	One digit (0 to 9) continuation card No. It was recognized that not all entries could be fully accomodated in one card and it would be necessary to continue to, at least, the second card. In order to indicate that a card contained the continued part of an earlier card this column would have 1 on the 1st continued card, 2 on the second and so on. The first card of every record would have 0 in this column. With this scheme of recording it was possible to bring together all cards pertaining to one record by merely sorting the records on Cols 3 to 9. This would put the card file in serial number order. The entries pertaining to any serial number would follow one another and the cards and the continued cards of any entry would also be in their logical order.
10-80	Keyword and context (separated by a "/").

The records punched according to the layout above were treated as variable length records for the purpose of sorting and merging. The '‡' symbol was used in order to indicate end of record. It was also used to indicate continued records. Thus if a '‡' was found on Col. 80 it meant that the record continued on the next card until a '‡' on that card. (The exception to this of course, was when a record ended exactly on Col. 79).

A sample of a punched data card is presented as item 2A & 2B in the Appendix.

It was felt that the above layout served two purposes.

(1) Ease at conversion time. By providing a numeric field at the begining of a record (the serial number of the abstract) punched operators were able to use the duplicate facility when there was more than one entry per abstract.

(2) The Index number being the first part of a record could be easily identified in disk sectors.

Programming

The computer used is the IBM 1620 (Model II). The peripherals available on the system used are a card reader, line printer and three disk units. The system accepts programmes in Fortran-II D and SPS-II D.

270606

The programmes necessary for the production of a hard copy of the index are as follows:

1. Edited input programme;
2. Sort programme; and
3. Edited output programme.

1. Edited input programme

The object of this programme is to store the data in disk and also to check for the following errors in the data.

(1) The absence of a ǂ(record mark) indicating the end of record.

(2) The absence of a '/' symbol that separates the keyword from the context.

Errors, such as the above, that could have occured at the time of punching are detected and the computer writes on the typewriter the contents of the card containing the error and halts in the manual mode. The operator can remove the card in order to correct it. In the meanwhile the computer continues to read other cards and store them on disk.

At the time of storage, tests are also made as to the optimum storage capacity needed for a record. In effect they are stored either as one sector records or two sector records keeping to a minimum the storage needed on disk. The Programme also takes care of the records that have overflowed into more than one card. In such cases the two halves of a record are consolidated and stored as one record for the future operations of sorting and output.

A flow chart of the edited input programme is given as item 6 in the Appendix. A portion of the listing is presented as item 3 in the Appendix. The programme was written in the SPS II-D language. The average reading time of the programme is of the order of 400 cards per minute.

2. Sorting

The Sort/Merge 047 described in the article under the Author Index is the programme used to sort the keyword index records on disk into the alphabetical order. The average time taken to sort the records for a monthly issue is about 11 minutes.

3. Edited output programme

The object of this programme is to print on the line printer the alphabetised index with the following points in view:

1. The width of a column of the index is never to exceed 40 characters or 4 inches. With this column width, it was found that three columns per page could be accommodated after suitable reduction.

2. The keyword was to form the first line of an entry followed by the context on the second line. The context is indented to distinguish it from the keyword.

3. When the keyword or context exceeded forty characters, they were to be continued on the second and subsequent lines. Continuation lines were to be indicated by a second indention.

4. The continued line was to start as far as possible, with a new word. When a word had to be broken on account of the limitation of the column width, the break had to occur so as to be intelligible (i.e. at least a few characters occuring before and after the break).

5. The column was also to be right justified. The index number (serial number of abstract) was to occur on the same line as the last line of the context.

6. When several entries under the same keyword occured, the keyword was to be suppressed in printing. That is only the context was to be printed, except in the case where the keyword occured for the first time.

The object of imposing all the above constraints on the output programme was in order to give the computer produced index as much readability and consulting ease as is considered essential in a mannually complied index. To all purposes and extent the result was a fairly close replica of the manually prepared index. However, it had the limitations of entries being only in capital letters and in one type face.

The programme was written in the SPS-II-D language. A flow chart is presented as item 7 in the Appendix. A portion of the listing and a sample of the output is presented as item 4 in the Appendix.

Problems

The use of the '/' symbol immediately after the keyword led to wrong placement of two worded keywords in the alphabetical sequence of keywords. That is to say single worded keywords, appeared later than the two worded keywords. An example will illustrate this point.

Desired Sequence	Produced Sequence
Fish	Fish Protiens
Fish Protiens	Fish Protiens, Processed
Fish Protiens, processed	Fish Traps
Fish Traps	Fish

This happened because the ordinal value of any symbol is greater than that of blank character. This was corrected by inserting a blank between the last character of a keyword and the '/'.

Another limitation is the break up of words, when either the keyword or context exceeded the column width of 40 characters. The break up is not in all cases intelligible.

A third limitation was the assumption that an entry would never exceed a maximum of 100 characters. When this happened the entry was truncated after the 100th character. This has resulted in incomplete entries in a few cases. Attempts are being made to overcome this limitation.

The 1311 disk pack is capable of sorting a maximum of 1 million alphameric characters. This is insufficient to hold completely the keyword index entries for a whole year. The Sort/Merge described above cannot be used for files that are larger than what can be held on one disk pack. This will pose problems at the time of cumulation.

Conclusions

The time taken to produce the hard copy of the index by the computer is as follows:

Conversion Time

Punching and Verification: 24 Man hrs.

Computer Time

Storage	8 minutes
Sorting	11 minutes
Printout	25 minutes
Total	44 minutes

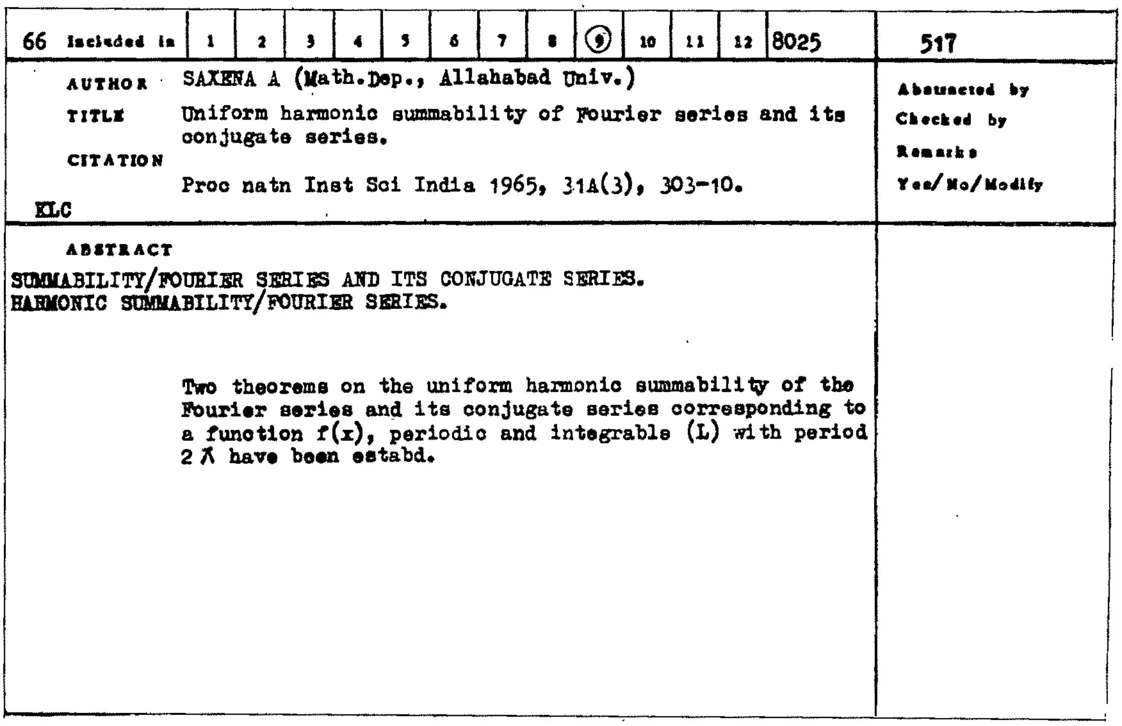
This work indicates new directions along which the efforts may be channelised, viz. developing an integrated programme for obtaining both the indexes from punched entries of ISA. Such a programme should take care of monthly merging of entries into the annual author and keyword index.

Based on this work, computer processing of the keyword index has been undertaken as a routine work of the Projects Division.

ACKNOWLEDGEMENTS

We wish to record our grateful thanks to Shri B. S. Kesavan, Director Insdoc for providing all the necessary facilities and to Shri S. Dutta, Editor Indian Science Abstracts and his colleagues for participating in fruitful discussions on keyword indexing.

APPENDIX



66 Included in	1	2	3	4	5	6	7	8	⑨	10	11	12	8025	517

AUTHOR SAXENA A (Math.Dep., Allahabad Univ.)

TITLE Uniform harmonic summability of Fourier series and its conjugate series.

CITATION Proc natn Inst Sci India 1965, 31A(3), 303-10.

KLC

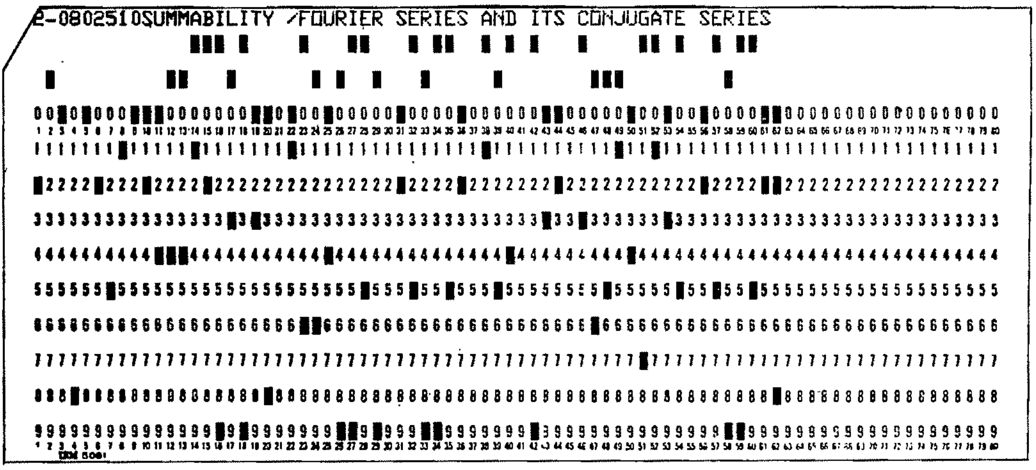
Abstracted by
Checked by
Remarks
Yes/No/Modify

ABSTRACT

SUMMABILITY/FOURIER SERIES AND ITS CONJUGATE SERIES.
HARMONIC SUMMABILITY/FOURIER SERIES.

Two theorems on the uniform harmonic summability of the Fourier series and its conjugate series corresponding to a function f(x), periodic and integrable (L) with period 2 π have been estabd.

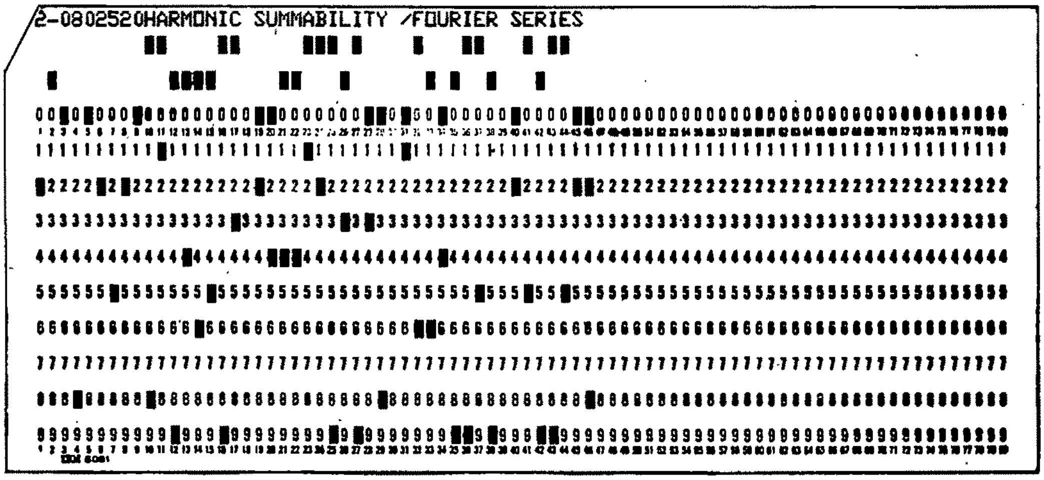
1. A Sample Process Slip



2-0802510SUMMABILITY /FOURIER SERIES AND ITS CONJUGATE SERIES

IBM 5081

2A. A Sample Data Card



2-0802520HARMONIC SUMMABILITY /FOURIER SERIES

2B. A Sample Data Card

3. Listing of Edited Input Programme

```
*STORE RELOADABLE
*NAME SINPUT
*IDNUMBER0173
      *EDITED INPUT PROGRAM FOR SUBJECT INDEX (ISA)
      *FIRST CARD CONTAINS STARTING SECTOR ADDRESS
      *WHERE DATA IS TO BE LOADED
      BUFR  DC  5,0
            DC  1,@
      MS    DAC 44,PARITY ERROR IN CARD.REMOVE CARD.FEED AGAIN@
      CARD  DAS 100
      RECMK DAC 1,@
      CARD1 DAS 80
            DAC 1,@
      BLANK DC  2,0
      MSAGE1DAC 50,RECORD-MARK NOT PUNCHED AT END OF RECORD.EXAMINE C
            DAC 43,ARD.CORRECT IT.TO CONTINUE JOB PRESS START@
      MSAGE2DAC 50,COL 80 CONTAINS A RECORDMARK.COL 9 CONTAINS A DIGI
            DAC 50,T OTHER THAN ZERO.REMOVE CARD PRESS START TO CONTI
            DAC 4,NUE@
      MSAGE3DAC 50,COL 80 CONTAINS A RECORDMARK.BUT NO RECORD MARK IS
            DAC 50, FOUND AT END OF RECORD.REMOVE CARD.PRESS START TO
            DAC 10, CONTINUE@
      MSAGE4DAC 50,COL 80 CONTAINS NEITHER RECORD MARK NOR BLANK.REMO
            DAC 33, VE CARD.PRESS START TO CONTINUE@
      DCF   DDA ,0,0,1,CARD-1
      DCF1  DDA ,0,0,1,CARD+99
      SPACESDC  50,0
            DC  1,-1
      NBLANKDNB 49
      DIGIT DC  2,0
      SWITCHDC  2,0
```

[Continued]

```
START RNCDCARD-1
      SF   CARD-1
      TF   DCF+5,CARD+4
      MF   DCF+1,DCF
      TF   CARD1+158,SPACES
      TF   CARD1+109,SPACES
      TF   CARD1+60,SPACES
      TF   CARD+198,SPACES
      TF   CARD+149,SPACES
      TF   CARD+100,SPACES
      TF   CARD+51,SPACES
      TFM  CARD+2,0,8
      TF   CARD1+49,SPACES
READ  RACDCARD
      BI   MES,0600
      BNR  COMP,CARD+2
      TF   CARD+198,NBLANK
      TF   CARD+149,NBLANK
      TF   CARD+100,NBLANK
      TF   CARD+51,NBLANK
      TF   CARD+2,SPACES+5
      TD   CARD+1,RECMK
      TD   CARD,RECMK
      TDM  CARD-1,0
      SK   DCF
      WDN  DCF
      CDN  DCF
      TF   BUFR,DCF+5
      CF   BUFR-4
      PRN  BUFR-4
      CALLEXIT
COMP  C    BLANK,CARD+158,7
      BNE  TEST1
SUBS  SM   COMP+11,2
      CM   COMP+11,CARD+16
      BE   TEST3
      BNR  SUBS,-COMP-11
TRY   CM   COMP+11,CARD+98
      BNH  1SEKTR
2SEKTRTFM  SWITCH,1,10
      BTM  SLSUB,*+11
RECORDBD   WRITE,DCF+5
      BD   WRITE,DCF+4
      TD   DIGIT,DCF+3
      MM   DIGIT,5,10
      BD   WRITE,99
      SK   DCF
WRITE WDN  DCF
      CDN  DCF
      CM   SWITCH,1,10
      BL   ADDONE
      BE   ADDTWO
1SEKTRCM   COMP+11,CARD+80
      BL   TRNS
SWOFF TFM  SWITCH,0,10
      BTM  SLSUB,*+11
      B7   RECORD
TRNS  TF   -COMP-11,BLANK
      SM   COMP+11,1
      CF   -COMP-11
      TF   CARD+80,RECMK
      CF   CARD+79
      B7   SWOFF
ADDONEAM   DCF+5,1
      TFM  COMP+11,CARD+158
      B7   READ
```

```
ADDTWOAM   DCF+5,1
      TF   DCF1+5,DCF+5
      TD   DCF1,DCF
      BD   NSEEK,DCF1+5
      BD   NSEEK,DCF1+4
      TD   DIGIT,DCF1+3
      MM   DIGIT,5,10
      BD   NSEEK,99
      SK   DCF1
NSEEK WDN  DCF1
      CDN  DCF1
      B7   ADDONE
TEST1 BNR  ERMES4,CARD+158
      BD   ERMES2,CARD+16
      C    BLANK,CARD+156
      BNE  CSOLID
      C    BLANK,CARD+154
      BNE  CSOLID
SUBS1 SM   COMP+11,2
      CM   COMP+11,CARD+16
      BE   ERMES3
      BNR  SUBS1,-COMP-11
      TF   CARD+158,BLANK
      CF   CARD+157
      B7   TRY
TEST3 C    BLANK,CARD+156
      BNE  TRANS1
      C    BLANK,CARD+154,7
      BE   ERMES1
TRANS1TF   CARD+158,RECMK
      CF   CARD+157
      B7   2SEKTR
ERMES1RCTY
      TFM  COMP+11,CARD+158
      WATYMSAGE1
      RCTY
      WATYCARD
      H
      B7   READ
ERMES2RCTY
      WATYMSAGE2
      RCTY
      WATYCARD
      H
      B7   READ
ERMES3TFM  COMP+11,CARD+158
      RCTY
      WATYMSAGE3
      RCTY
      WATYCARD
      H
      B7   READ
ERMES4RCTY
      WATYMSAGE4
      RCTY
      WATYCARD
      TFM  ERMES4+42,CARD
      H
      B7   READ
MES   WATYMS
      RCTY
      TF   CARD+18,RECMK
      CF   CARD+17
      WATYCARD
      H
      B7   READ
```

[Continued]

```
*ROUTINE TO TEST FOR PRESENCE OF SLASH
SLASH DC  2,21
MESAGEDAC 48,SLASH NOT FOUND.REMOVE CARD.
                         CORRECT.PRESS STARTa

      DC  5,0
SLSUB CM  SWITCH,1,10
      BE  TWOTST
ONETSTC   SLASH,CARD+18,7
      BE  OVER
      AM  ONETST+11,2
      CM  ONETST+11,CARD+98
      BL  ONETST
      RCTY
      WATYMESAGE
      TF  CARD+98,RECMK
      RCTY
      WATYCARD
      TFM ONETST+11,CARD+18
      TFM ONETST+47,CARD+98
      TFM COMP+11,CARD+158
      H
      B7  READ
OVER  TFM ONETST+11,CARD+18
      TFM ONETST+47,CARD+98
      BB
TWOTSTTFM ONETST+47,CARD+198
      B7  ONETST
*ROUTINE FOR CONSOLIDATION

CSOLIDRACDCARD1
      C   BLANK,CARD1+158
      BE  *+24
      BNR ERMES,CARD1+158
      SF  CARD+3
      SF  CARD1+3
      C   CARD+14,CARD1+14
      BNE NXT
TST   BNR SUBS2,CARD1+54,7
      TFM TST+11,CARD1+54
      B7  PUTRM+24
```

```
SUBS2 SM  TST+11,2
      CM  TST+11,CARD1+16
      BE  PUTRM
      B7  TST
PUTRM TF  CARD1+54,RECMK
      TFM TST+11,CARD1+54
      CF  CARD1+53
      SF  CARD1+17
      TR  CARD+157,CARD1+17
      CF  CARD+157
      B7  2SEKTR
NXT   TFM SWITCH,1,10
      BTM SLSUB,*+11
      BD  WRT,DCF+5
      BD  WRT,DCF+4
      TD  DIGIT,DCF+3
      MM  DIGIT,5,10
      BD  WRT,99
      SK  DCF
WRT   WDN DCF
      CDN DCF
      AM  DCF+5,1
      TF  DCF1+5,DCF+5
      TD  DCF1,DCF
      BD  WRT1,DCF1+5
      BD  WRT1,DCF1+4
      TD  DIGIT,DCF1+3
      MM  DIGIT,5,10
      BD  WRT1,99
      SK  DCF1
WRT1  WDN DCF1
      CDN DCF1
      CF  CARD1+3
      CF  CARD1+17
      SF  CARD1-1
      TF  CARD+158,CARD1+158
      AM  DCF+5,1
      B7  COMP
ERMES TFM ERMES4+42,CARD1
      B7  ERMES4
      DENDSTART
```

4. Listing of Edited Output Programme

```
*STORE RELOADABLE
*NAME SINDEX
      *SUBJECT INDEX PROGRAM FOR OUTPUT
      *FIRST DATA CARD CONTAINS STARTING SECTOR ADDRESS
      *AND NO OF SECTORS TO BE PROCESSED
      MSAGE1DAC 41,SLASH NOT FOUND.RECORD IGNORED IN OUTPUTa
      MSAGE2DAC 46,RECORDMARK NOT FOUND.RECORD IGNORED IN OUTPUTa
      ZEROS DC  8,0
      HYPHENDC  4,200a
      BLANK BC  2,0
      SPACESDC  50,0
      SECKNTDC  5,0
      KNTR  DC  5,0
      KEY   DAS 100
            DC  4,0
```

[Continued]

```
CONTXTDAS 100
ENTRY DAS 100
RECMK DAC 1,@
DCF   DDA ,0,0,1,ENTRY-1
DCF1  DDA ,0,0,1,ENTRY+99
SLASH DC  2,21
DIGIT DC  2,0
INDEX DSA 0
SWITCHDC  2,0
KEYWRDDS  ,KEY+198
BUFFERDAS 100
      DC  8,0
BUFR  DAS 34
      DAC 1,@
      DC  12,0
BUFR1 DAS 40
      DAC 1,@
START RNCDENTRY-1
      SF  ENTRY-1
      TF  DCF+5,ENTRY+4
      MF  DCF+1,DCF
      SF  ENTRY+5
      TF  SECKNT,ENTRY+9
      TF  ENTRY+198,SPACES
      TF  ENTRY+149,SPACES
      TF  ENTRY+100,SPACES
READ  BD  NSEEK,DCF+5
      BD  NSEEK,DCF+4
      TD  DIGIT,DCF+3
      MM  DIGIT,5,10
      BD  NSEEK,99
      SK  DCF
NSEEK RDN DCF
      AM  KNTR,1
      C   KNTR,SECKNT
      BH  HALT
TEST  BNR SUBS,ENTRY+98,7
      TF  INDEX,TEST+11
      TFM TEST+11,ENTRY+98
COMP  C   SLASH,ENTRY+18,7
      BE  TEST1
      AM  COMP+11,2
      C   COMP+11,INDEX
      BE  ERROR1
      B7  COMP
SUBS  SM  TEST+11,2
      CM  TEST+11,ENTRY+16
      BE  NXTSEK
      B7  TEST
TEST1 TF  INDEX,COMP+11
      TFM COMP+11,ENTRY+18
      SF  ENTRY+17
      SM  INDEX,2
      C   KEYWRD,-INDEX
      BNE TRANS
      C   -INDEX,KEYWRD
      BE  TRCNTX
TRANS TF  KEYWRD,-INDEX
      AM  INDEX,2
      TF  -INDEX,RECMK
      AM  INDEX,2
      BNR LNTST1,-INDEX
      SM  INDEX,4
K1    CM  INDEX,ENTRY+84
      BNH 1LINE
      TFM SWITCH,0,10
```

```
2LINESSF  ENTRY+17
      TF  BUFFER+198,SPACES
      TF  BUFFER+149,SPACES
      TF  BUFFER+100,SPACES
      CF  BUFFER+51
      TR  BUFFER-1,ENTRY+17
K2    TF  BUFR+66,BUFFER+66
      PRA BUFR
      BTM NUPAGE,*+11
K3    C   ZEROS,BUFFER+140
      BNE 3LINES
K4    SF  BUFFER+67
      TF  BUFR1+78,SPACES
      TF  BUFR1+48,SPACES
K5    TRNMBUFR1-1,BUFFER+67
      CM  SWITCH,1,10
      BE  PRKWRD
      SF  ENTRY+3
K6    TF  BUFR1+76,ENTRY+12
      PRA BUFR1-2
      BTM NUPAGE,*+11
      AM  DCF+5,1
      B7  READ
3LINESSF  BUFFER+67
K7    TF  BUFR+64,BUFFER+132
K8    TF  BUFR+66,RECMK
      PRA BUFR-2
      BTM NUPAGE,*+11
K9    SF  BUFFER+133
      TF  BUFR1+78,SPACES
      TF  BUFR1+48,SPACES
K10   TRNMBUFR1-1,BUFFER+133
      CM  SWITCH,1,10
      BE  PRKY1
      SF  ENTRY+3
K11   TF  BUFR1+76,ENTRY+12
      PRA BUFR1-2
      BTM NUPAGE,*+11
      AM  DCF+5,1
      B7  READ
PRKY1 PRA BUFR1-2
      BTM NUPAGE,*+11
      B7  TRCNTX
LNTST1C   BLANK,-INDEX
      BE  K1-12
      SM  INDEX,4
      CM  INDEX,ENTRY+84
      BNH 1LINE1
      TFM SWITCH,1,10
      B7  2LINES
PRKWRDPRA BUFR1-2
      BTM NUPAGE,*+11
TRCNTXAM  INDEX,3
      SF  -INDEX
      TF  CONTXT+198,SPACES
      TF  CONTXT+149,SPACES
      TF  CONTXT+100,SPACES
      TF  CONTXT+51,SPACES
      TFM CONTXT+2,0,8
      TRNMCONTXT-1,-INDEX
      B7  NEW
1LINE TF  BUFR1+78,SPACES
      TF  BUFR1+48,SPACES
      SF  ENTRY+17
      TRNMBUFR1-1,ENTRY+17
      SF  ENTRY+3
```

[Continued]

```
K13    TF  BUFR1+78,ENTRY+12
       PRA BUFR1
       BTM NUPAGE,*+11
       AM  DCF+5,1
       B7  READ
1LINE1PRA ENTRY+18
       B7  TRCNTX
NXTSEKAM  DCF+5,1
       TF  DCF1+5,DCF+5
       TD  DCF1,DCF
       TFM TEST+11,ENTRY+98
       BD  NSEEK1,DCF1+5
       BD  NSEEK1,DCF1+4
       TD  DIGIT,DCF1+3
       MM  DIGIT,5,10
       BD  NSEEK1,99
       SK  DCF1
NSEEK1RDN DCF1
       AM  KNTR,1
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       TF  INDEX,TEST2+11
       TFM TEST2+11,ENTRY+198
       B7  COMP
SUBS1  SM  TEST2+11,2
       CM  TEST2+11,ENTRY+16
       BE  ERROR2
       B7  TEST2
ERROR1RCTY
       WATYMSAGE1
       TFM COMP+11,ENTRY+18
       RCTY
       AM  DCF+5,1
       TF  ENTRY+98,RECMK
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       B7  READ
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       TFM TEST2+11,ENTRY+198
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       DC  5,0
NUPAGEBNI *+24,3400
       SKIP,1
       BB
NEW    C   ZEROS,CONTXT+70
       BE  ONELIN
       C   ZEROS,CONTXT+130
       BNE 3LINE
       C   ZEROS,CONTXT+122
       BNE R2LINE
F2LINEC   BLANK,CONTXT+64
       BE  TYPE1
       C   BLANK,CONTXT+62
       BE  TYPE2
       C   BLANK,CONTXT+60
       BE  TYPE3
       C   BLANK,CONTXT+58
       BE  TYPE4
       C   BLANK,CONTXT+56
       BE  TYPE5
       C   BLANK,CONTXT+54
```
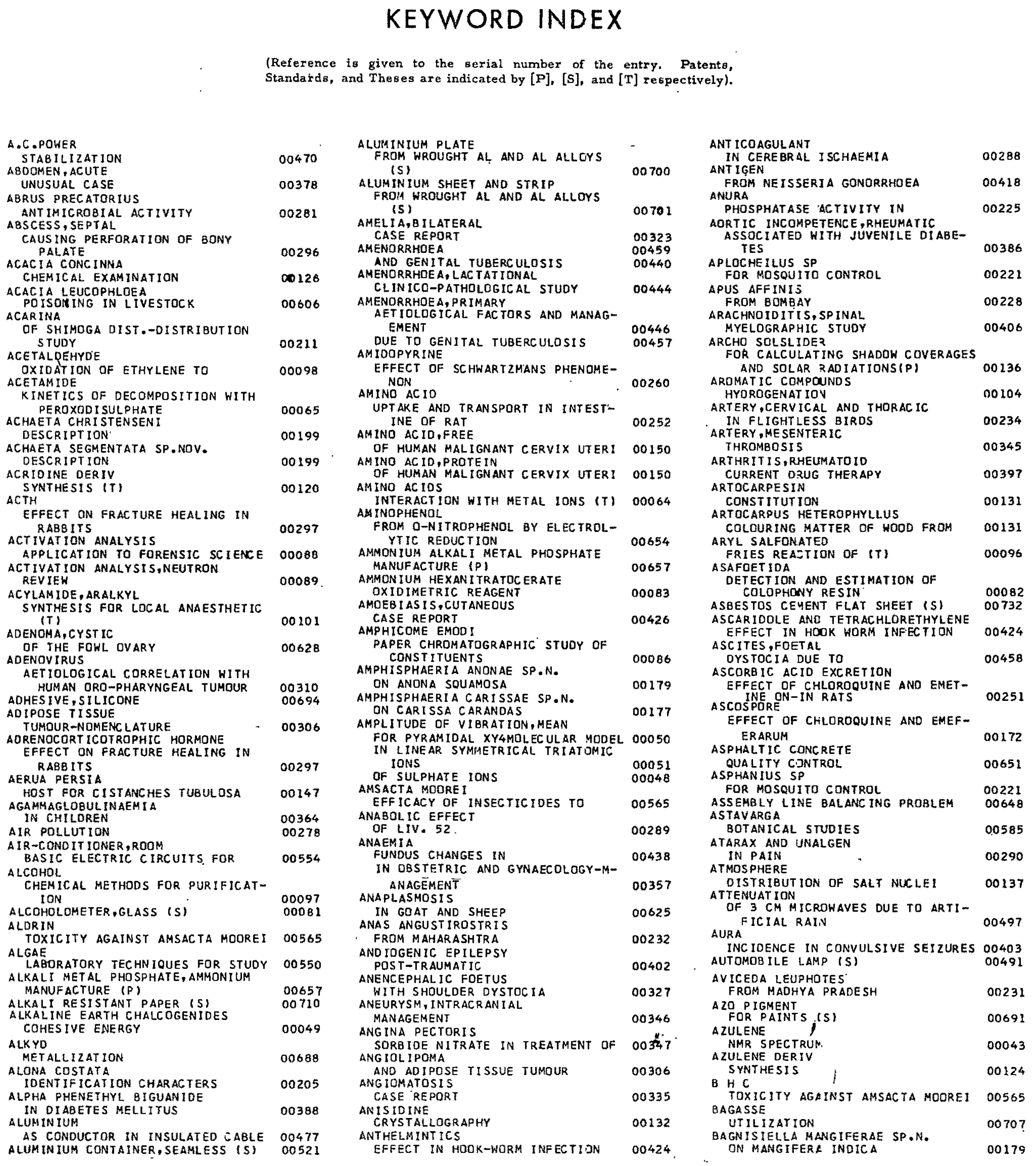

```
       BE  TYPE6
       C   BLANK,CONTXT+52
       BE  TYPE7
       TF  BUFR+58,CONTXT+58
       TF  BUFR+62,HYPHEN
       PRA BUFR-4
       BTM NUPAGE,*+11
       SF  CONTXT+59
       TF  CONTXT+124,RECMK
       TF  BUFR1+78,SPACES
       TF  BUFR1+48,SPACES
       TRNMBUFR1-1,CONTXT+59
PRNT   SF  ENTRY+3
       TF  BUFR1+70,ENTRY+12
       PRA BUFR1-8
       BTM NUPAGE,*+11
       AM  DCF+5,1
       B7  READ
TYPE1  TF  CONTXT+64,RECMK
       PRA CONTXT-4
       BTM NUPAGE,*+11
       TF  CONTXT+124,RECMK
       SF  CONTXT+65
       TF  BUFR1+78,SPACES
       TF  BUFR1+48,SPACES
       TRNMBUFR1-1,CONTXT+65
       B7  PRNT

TYPE2  TF  CONTXT+62,RECMK
       PRA CONTXT-4
       BTM NUPAGE,*+11
       TF  CONTXT+124,RECMK
       SF  CONTXT+63
       TF  BUFR1+78,SPACES
       TF  BUFR1+48,SPACES
       TRNMBUFR1-1,CONTXT+63
       B7  PRNT

TYPE3  TF  CONTXT+60,RECMK
       PRA CONTXT-4
       BTM NUPAGE,*+11
       TF  CONTXT+124,RECMK
       SF  CONTXT+61
       TF  BUFR1+78,SPACES
       TF  BUFR1+48,SPACES
       TRNMBUFR1-1,CONTXT+61
       B7  PRNT
TYPE4  TF  CONTXT+58,RECMK
       PRA CONTXT-4
       BTM NUPAGE,*+11
       TF  CONTXT+124,RECMK
       SF  CONTXT+59
       TF  BUFR1+78,SPACES
       TF  BUFR1+48,SPACES
       TRNMBUFR1-1,CONTXT+59
       B7  PRNT

TYPE5  TF  CONTXT+56,RECMK
       PRA CONTXT-4
       BTM NUPAGE,*+11
       TF  CONTXT+124,RECMK
       TF  BUFR1+78,SPACES
       TF  BUFR1+48,SPACES
       SF  CONTXT+57
       TRNMBUFR1-1,CONTXT+57
       B7  PRNT
```

[Continued]

```
TYPE6 TF  CONTXT+54,RECMK
      PRA CONTXT-4
      BTM NUPAGE,*+11
      TF  CONTXT+124,RECMK
      SF  CONTXT+55
      TF  BUFR1+78,SPACES
      TF  BUFR1+48,SPACES
      TRNMBUFR1-1,CONTXT+55
      B7  PRNT
TYPE7 TF  CONTXT+52,RECMK
      PRA CONTXT-4
      BTM NUPAGE,*+11
      TF  CONTXT+124,RECMK
      SF  CONTXT+53
      TF  BUFR1+78,SPACES
      TF  BUFR1+48,SPACES
      TRNMBUFR1-1,CONTXT+53
      B7  PRNT
R2LINEC   BLANK,CONTXT+64
      BE  TYPE1
      C   BLANK,CONTXT+62
      BE  TYPE2
      C   BLANK,CONTXT+60
      BE  TYPE3
      TF  BUFR+62,CONTXT+62
      TF  BUFR+64,RECMK
      PRA BUFR-4
      TF  CONTXT+124,RECMK
      SF  CONTXT+63
      TF  BUFR1+78,SPACES
```

```
      TF  BUFR1+48,SPACES
      TRNMBUFR1-1,CONTXT+63
      B7  PRNT
ONELINTF  CONTXT+76,RECMK
      SF  ENTRY+3
      TF  CONTXT+74,ENTRY+12
      PRA CONTXT-4
      BTM NUPAGE,*+11
      AM  DCF+5,1
      B7  READ
3LINE TF  BUFR+62,CONTXT+62
      TF  BUFR+64,RECMK
      PRA BUFR-4
      BTM NUPAGE,*+11
      SF  CONTXT+63
      TF  BUFR+58,CONTXT+122
      TF  BUFR+60,RECMK
      PRA BUFR-8
      BTM NUPAGE,*+11
      SF  CONTXT+123
      TF  BUFR1+78,SPACES
      TF  BUFR1+48,SPACES
      TF  CONTXT+180,RECMK
      TRNMBUFR1-1,CONTXT+123
      SF  ENTRY+3
      TF  BUFR1+70,ENTRY+12
      PRA BUFR1-8
      AM  DCF+5,1
      B7  READ
      DENDSTART
```

KEYWORD INDEX TO ISA



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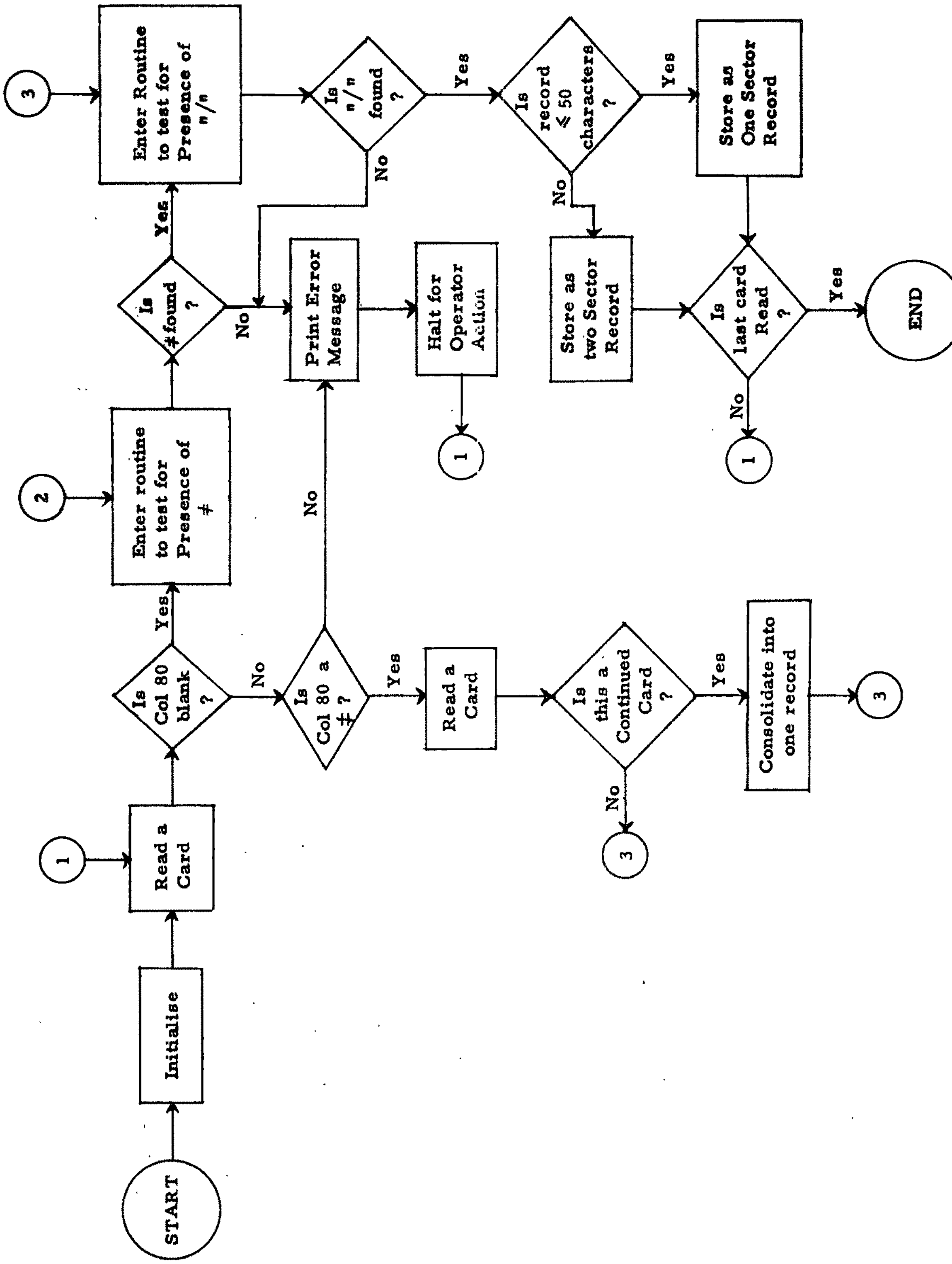
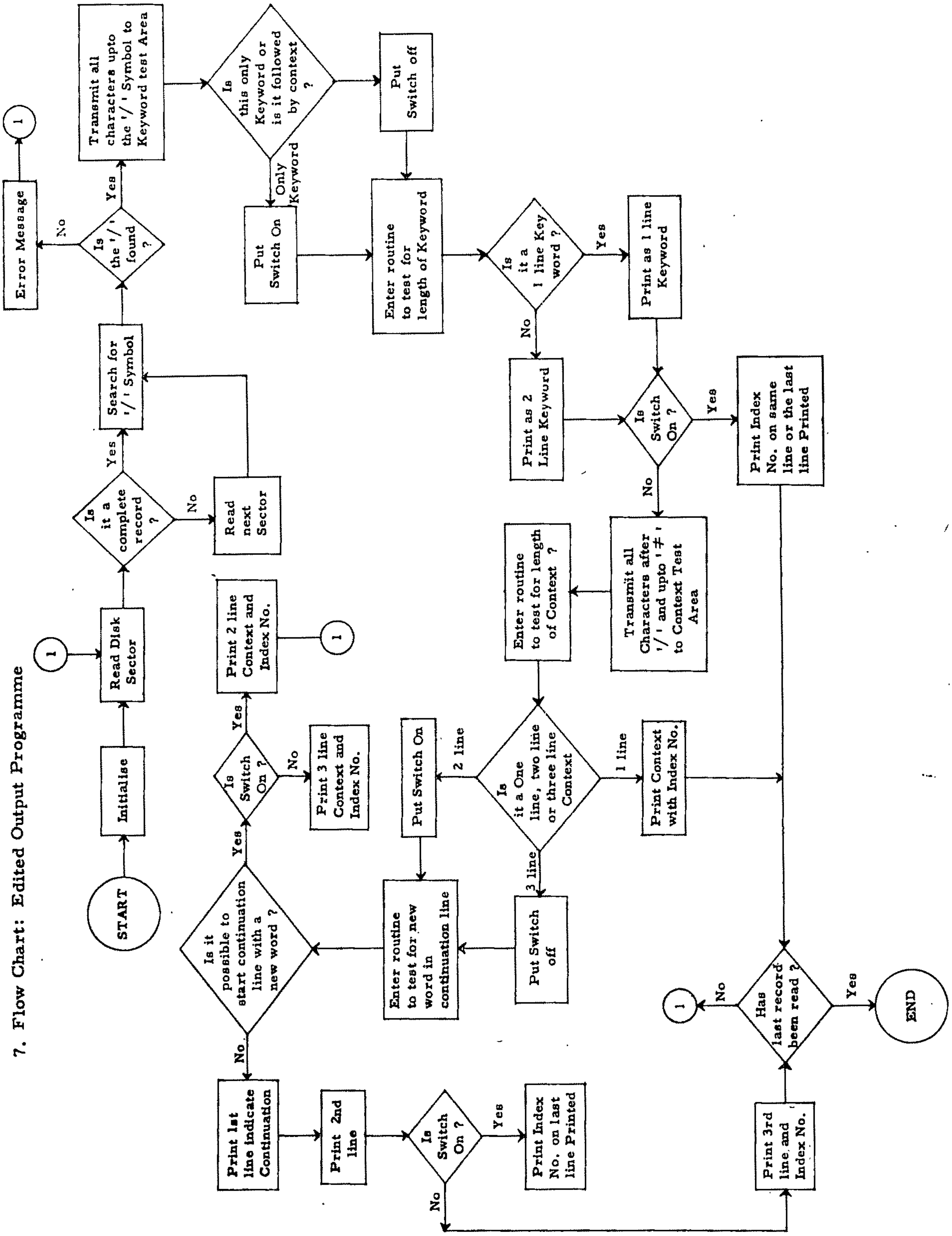
5. A Sample Page of Keyword Index


START
Initialise
1
Read a Card
Is Col 80 blank ?
Yes
No
2
Enter routine to test for Presence of ≠
Is ≠ found ?
Yes
No
3
Enter Routine to test for Presence of "/"
Is "/" found ?
Yes
No
Is record ≤ 50 characters ?
Yes
No
Store as One Sector Record
Store as two Sector Record
Is last card Read ?
Yes
No
END
1
Print Error Message
Halt for Operator Action
1
Is Col 80 a ≠ ?
Yes
No
Read a Card
Is this a Continued Card ?
Yes
No
3
Consolidate into one record
3

8. Flow Chart: Edited Input Programme [Keyword Index]



7. Flow Chart: Edited Output Programme

START
Initialise
1
Read Disk Sector
Is it a complete record ?
Yes
No
Read next Sector
Search for '/' Symbol
Is the '/' found ?
No
Error Message
1
Yes
Transmit all characters upto the '/' Symbol to Keyword test Area
Is this only Keyword or is it followed by context ?
Only Keyword
Put Switch On
Put Switch off
Enter routine to test for length of Keyword
Is it a 1 line Key word ?
Yes
Print as 1 line Keyword
No
Print as 2 Line Keyword
Is Switch On ?
Yes
Print Index No. on same line or the last line Printed
No
Transmit all Characters after '/' and upto '≠' to Context Test Area
Enter routine to test for length of Context ?
Is it a One line, two line or three line Context
1 line
Print Context with Index No.
2 line
Put Switch On
3 line
Put Switch off
Enter routine to test for new word in continuation line
Is it possible to start continuation line with a new word ?
Yes
Is Switch On ?
Yes
Print 2 line Context and Index No.
1
No
Print 3 line Context and Index No.
No
Print 1st line indicate Continuation
Print 2nd line
Is Switch On ?
Yes
Print Index No. on last line Printed
No
Print 3rd line and Index No.
Has last record been read ?
No
1
Yes
END

INFORMATION RETRIEVAL BY ELECTRONIC DIGITAL COMPUTER

P C JAIN
SHIPRA GUPTA
Structural Engineering Research Centre, Roorkee

Describes the experiment on the application of IBM 1620 computer for IR work. Uses Fortran II for programming the experiment. Uses accession number as a link between the keyword and the document on the shelf. The experiment is based on the principle of uniterm indexing.

INTRODUCTION

Communication between individuals, groups and communities at national and international level has increased at a formidable rate since the days of Egyptian Pyramids. There is a constant flow of research and other publications in all subjects in the libraries. The storage and retrieval of the publications have posed new problems to the librarians and information scientists. The digital computer can be effectively used to render this service.

The growing volume of research publications on one hand and increasing specialisation of the reader on the other will demand that library services should be more specific, individualised and quick. The research workers on widely varying and highly specialised fields will have to be catered to with speed and without redundant information.

APPLICATIONS OF COMPUTERS TO DOCUMENTATION

Information and communication theories are very wide subjects engaging the attention of a number of research workers all over the world and giving rise to new branches of knowledge such as Bionics, Cybernatics, Diffusion Theory and Stochastic processes etc. Computers are being successfully employed as versatile tools in business management, accounting and in banks. Even in war time, the computer is programmed to formulate a strategy and also to answer other questions related to operation control. The exponential growth of the information storage and retrieval problem in all branches of knowledge has given rise to the solution of the problem through the computer. Computers are programmed to search discursive information in any suitable manner.

MACHINE CONFIGURATION

An IBM 1620 model I, Electronic Digital Computer (at Structural Engineering Research Centre) has been used for the information retrieval. It has the following three units:

i) IBM 1620 Data Processing System - it consists of arithmetic and logic units, magnetic core storage of 20,000 locations and the console panel and typewriter;

ii) IBM 1623 Core Storage - it has 40,000 additional locations which make the total storage of the system equal to 60,000 locations; and

iii) IBM 1622 Card Read Punch - this is a input and output unit for the system. The information is entered through punched cards by this unit and the processed information is recorded in the form of punched cards by the same unit.

The information entered into the system is placed in core storage as decimal digits. The numericals 0 - 9 are represented by one decimal digit, while the alphabets and the special characters such as +-=/ * etc. by two decimal digits. Thus maximum 30,000 alphabets or special characters or 60,000 numericals can be stored in the system. Normally the computer works on a precision ff = 08 and kk= 05 (ff is the mantissa length and kk is the integer length) but it can work on variable precision (ff can vary from 2 to 28 and kk from 4 to 10) if desired.

PUNCH CARD CONCEPT

The information entered to the system is stored in the form of punched cards by the use of punching machine. A standard Fortran card has 80 columns and 12 rows. A numerical will have one punch hole in one column and an alphabet has two punch holes in the same column. A special character may have one, two or three punch holes in the same column. The punching positions for the rows 0 to 9 are called numerical punching positions and for rows 12, 11, 0 as zone punching positions. Zero row represents both numerical or zone punching positions. Information is recorded by operating a key punch (representing either a numerical, alphabetical or special character) which perforates the card according to the standard code for each numerical, alphabetical and special character that is to be recorded. Manipulation of these punched cards is very convenient. If a new information is to be recorded e. g. a new book arrives in the library, we have simply to punch cards giving information about the book and keep the cards on the information file. Information recorded on these punched cards may be reproduced very easily by accounting machines. The standard card codes for different types of characters used for the system are shown in Figure 1.

RETRIEVAL PROCEDURE

(a) Policy Formulation

Before starting the machine literature search, the documents that are to be included in the retrieval programme have to be recorded. A clear decision has to be taken initially as to the degree of analysis or inclusion of facets in records that will match the varied questions to be put to the system.

(b) Keywords

Information stored in files, is grouped into items represented by some important words, from the document. The 'key words' or subject headings express in one word or phrase the various isolates and facets of a subject. Such words or headings are used only to select documents on the subject represented by it. For example, in our library which specialises in publications on structural engineering and allied fields, key words chosen would be like this 'STRUCTURE' 'ANALYSIS', 'DESIGN', 'TESTING', 'SHELLS', 'CYLINDRICAL', 'HYPERBOLIC', 'THIN ELASTIC' etc. In some other collection which caters to social scientists engaged in politics the key words would be assigned thus e. g. 'POLITICAL SCIENCE', 'THEORY', 'INSTITUTIONS', 'PARTIES', 'MANIFESTO', 'INTERNATIONAL-RELATION' etc. In medical libraries literature may be assigned with key words denoting the disease, symptom, treatment and cure etc.

The subject headings or key words should be controlled and be able to match the probable search.

In order to mechanise the control of terminology, it is necessary to prepare a dictionary of key words or phrases that are likely to be selected by analysis together with accepted headings for the terms. Key words should be designed so as to have one-one correspondence with the intended meanings; with synonyms clearly identified and leaving no room for ambiguity. When practiced on a wider scale, this calls for a standardised reference manual and different systems of retrieval have either different glossaries or different data processing equipment or both. These key words which also form a part of input data are stored in punched cards or tapes depending upon the facilities available.

(c) Document Analysis

This is the second step in which the documentalist pinpoints the central theme from each listed document so as to represent its thought content. This can be done by the assigning of index criteria like key words, uniterms etc. In assigning the indices like key words one proceeds from a microthought to a macrothought. Many facets of the subject included in a document are singled out by assigning separate keywords e. g. the word computer may include many macrothoughts like digital, analogue, languages, programming etc. depending upon the extension and intension of the subject dealt. Programming the machine to search the literature in terms of its basic class, facets and isolates is one of the vital aspects of machine literature survey. The machine has to be fed with all the facets of a subject at the stage of storage of entries. At the stage of programming also the computer has to be instructed to match the various macrothoughts with the actual literature available on those facets and replying to the query of the reader.

(d) Computer Programming

The programme is written in Fortran language. It is a general programme and can be successfully used for libraries, having the facilities of a computer with large back storage. The data of the library may consist of millions of characters and can only be stored on any of the back storage devices i.e. magnetic tapes or discs etc. The information thus stored once, may be used for retrieval without difficulty. On the other hand, in computers like IBM 1620 available at our Centre (60 K memory locations), only limited data can be stored at a time for retrieval.

After feeding the input data, the computer proceeds logically according to the programme whose flow chart is given as item 2 and the computer programme in Fortran language is given in the appendix. It starts searching the first key word of the query with the existing key words and if the key word is available, it stores all the accession numbers related to that key word in area 'C'. After matching the first key word of the query, the computer starts searching the next key word and stores the related accession numbers of the key word in area 'D', if it matches. The common numbers of area 'C' and 'D' are only retained in area 'C'. The unmatched key words if any, of the query will be printed out on the typewriter. This process is repeated till all the key words of the query have been searched.

Finally the details of the selected accession numbers are punched as output.

(e) Input Data

The details of the input data are given below:

i) Total no. of key words

FORMAT (I4)

Cols 1-4 - Total no. of key words in dictionary.

ii) Key words with accession numbers

FORMAT (3A4, I4, (14I4))

Cols 1-12 - Name of the key word

Cols 13-16 - Total accession numbers in the keyword

Cols 17-72 - Accession numbers relating to the key word (fourteen acc. numbers each having four columns are punched)

The remaining accession numbers, if any, will be punched on successive cards having fourteen numbers on each card (cols 1-56).

iii) Total Number of Documents

FORMAT (I4)

Cols 1-4 - Total no. of documents

iv) Details of documents

Two cards are used for the details of each document.

FORMAT (I4, 17A4/18A4)

First Card

Cols 1-4 - Accession number

Cols 5-32 - Author's name

Cols 33-73)
Second Card) - Title
Cols 1-25)

Cols 25-72 - Source

v) Key words to be retrieved

FORMAT (18A4)

Cols 1-72 - Six words each having twelve columns

As an illustration for the newly established library at the Structural Engineering Research Centre the total number of key words that have been coined for the various types of books on Mathematics, Computers, Concrete etc. are about one hundred. Each book contains accession number denoting the serial order in which the book is taken on stock e.g. 137 is the accession number of the book entitled 'statically indeterminate structures' by L.C. Maugh. The publisher's name is John Wiley & Sons Inc. New York 1964. Suppose a reader asks for books available in the Library on the design of prestressed concrete. In that case three key words viz. 'CONCRETE', 'PRESTRESSED' and 'DESIGN' would be fed alongwith the other input data. A sample input data is given in the next page.

Sample Input Data

```
TOTAL KEY WORDS IN THE DICTIONARY

 101

KEY WORDS WITH ACCESSION NUMBERS

COMPUTER        86  22  25  27  52 139 143 161 212 132 214 215 801 802 803
 804 805 806 807 808 809 810 811 812 813 814 815 816 817
 819 820 821 822 823 824 825 826 827 828 829 830 831 834
 836 837 838 839 841 870 871 872 875 876 877 878 879 880
 882 883 884 885 886 888 890 896 897 898 899 900 901 902
 904 905 910 911 912 913 914 915 916 918 919  21 818 835
 881 903

DIGITAL         86  22  25  27  52 139 143 161 212 132 214 215 801 802 803
 804 805 806 807 808 809 810 811 812 813 814 815 816 817
 819 820 821 822 823 824 825 826 827 828 829 830 831 834
 836 837 838 839 841 870 871 872 875 876 877 878 879 880
 882 883 884 885 886 888 890 896 897 898 899 900 901 902
 904 905 910 911 912 913 914 915 916 918 919  21 818 835
 881 903

ANALOGUE         2 808 821

LANGUAGES        9 826 827 878 879 888 132 900 875  25

PROGRAMMING     21 139 161 802 806 810 825 830 834 839 872 876 878 879 882
 884 890 900 910 132 886  22

TECHNOLOGY      23 808 809 810 811 815 816 817 818 820 821 824 828 829 839
 870 881 897 899 905 913 915 916 807

COMPMETHODS     18 805 814 822 837 838 841 883 901 902 903 904 911 912 915
 916 918 919 143

APPLICATIONS    21 212 214 133 801 803 812 823 831 835 836 841 872 880 896
 898 901 902 903 904 914  27

SCIENCES        10 801 872 896 898 914 901 902 903 904  27

ENGINEERING      9 214 803 812 835 836 871 880 898 212

BUSINESS         3 823 831 133

- - - - - - -

TOTAL NO. OF DOCUMENTS

  60

DETAILS OF DOCUMENTS

  25PLUMB,S.C.                  INTRODUCTION TO FORTRAN.
                          MCGRAW HILL BOOK COMPANY. INC. NEW YORK 1964.

 132MCCRACKEN, D.D.             A GUIDE TO COBOL PROGRAMMING.
                          JOHN WILEY AND SONS. NEW YORK. 1963.

- - - - - - - - - -

KEY WORDS TO BE RETRIEVED

COMPUTER    DIGITAL     LANGUAGES
```

(f) Output

Output of the information retrieval programme consists of details of documents about a particular subject of which the key words are matched, in the FORMAT (I4/7A4/4X16A4/4X12A4). The accession number, author's name, title and source are punched on four cards separately. The sample output on Digital Computer Languages with the key words 'COMPUTER', 'DIGITAL', and 'LANGUAGES' is given below:

```
  25
PLUMB,S.C.
    INTRODUCTION TO FORTRAN.
    MCGRAW HILL BOOK COMPANY. INC. NEW YORK 1964.

 132
MCCRACKEN, D.D.
    A GUIDE TO COBOL PROGRAMMING.
    JOHN WILEY AND SONS. NEW YORK. 1963.

 826
COLMAN,H.L.
    COMPUTER LANGUAGE AN AUTOINSTRUCTIONAL  INTRODUCTION TO FORTRAN.
    MCGRAW HILL BOOK COMPANY.INC.NEW YORK. 1962.

 827
GALLER,B.A.
    THE LANGUAGE OF COMPUTERS.
    MCGRAW HILL BOOK COMPANY.INC.NEW YORK. 1962.

 875
CORBATO,F.J.
    THE COMPATIBLE TIME SHARING SYSTEM.
    M.I.T.U.S.A. 1963.

 878
LEESON,D.N. AND DIMITRY.
    BASIC PROGRAMMING CONCEPTS AND I.B.M.   1620. COMPUTER.
    HOLT RINEHART AND WINSTON.NEW YORK. 1962.

 879
MCCRACKEN,D.D.
    A GUIDE TO FORTRAN PROGRAMMING.
    JOHN WILEY AND SONS. INC. NEW YORK. 1964.

 888
RANDELL,B.
    ALGOL 60 IMPLEMENTATION.
    ACADEMIC PRESS. LONDON. 1964.

 900
IVERSION,K.E.
    A PROGRAMMING LANGUAGE
    JOHN WILEY AND SONS.INC.NEW YORK.LONDON. 1962.
```

CONCLUSION

The computer is programmed to carry out searching of information from stored data. The intelligent analysis, indexing, formulation of the query and the glossary formulating the flow chart and preparing the programme for any specific library have still to be done by the librarian. In fact, the effectivity of the mechanised information retrieval depends as much on the detailed knowledge of the subject and the needs of the reader on the part of the analyst as on the storage capacity and speed of the computer and comprehensiveness of the literature available.

Use of sophisticated computers in information retrieval is not so much a fad or a fashion as an inevitable by-product of the tremendous explosion of knowledge. The speed and accuracy of the tools available and the highly specialised needs of the reader demanding attention are a challenge to the ingenuity of even the most progressive information analyst. A modest beginning has been made at the Computer Centre of the Structural Engineering Research Centre at Roorkee with the hope that it will grow.

ACKNOWLEDGEMENT

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APPENDIX

Computer Programme in the Fortran Language.

```
C  C   INFORMATION RETRIEVAL PROGRAMME
       DIMENSION AA(480),IACC(1000),SR(30),ISAC(100),ITAC(100),ITN(110)
       DIMENSION IAN(100),DETL(3150)
70     READ 1,N
       L=N*3
       KL=1
       J=1
       DO 5 I=1,L,3
       JA=I
       JB=JA+2
       READ 4, (AA(JC),JC=JA,JB),K,(ISAC(JC),JC=1,K)
       IK=KL+K-1
       ITN(J)=K
       IJ=1
       DO 9 JC=KL,IK
       IACC(JC)=ISAC(IJ)
 9     IJ=IJ+1
       KL=KL+K
 5     J=J+1
       K=1
       KK=1
       JA=1
69     READ 1 ,M
       IA=1
       DO 60 IN= 1,M
       IB=IA+34
       READ61,IAN(IN),(DETL(J),J=IA,IB)
```

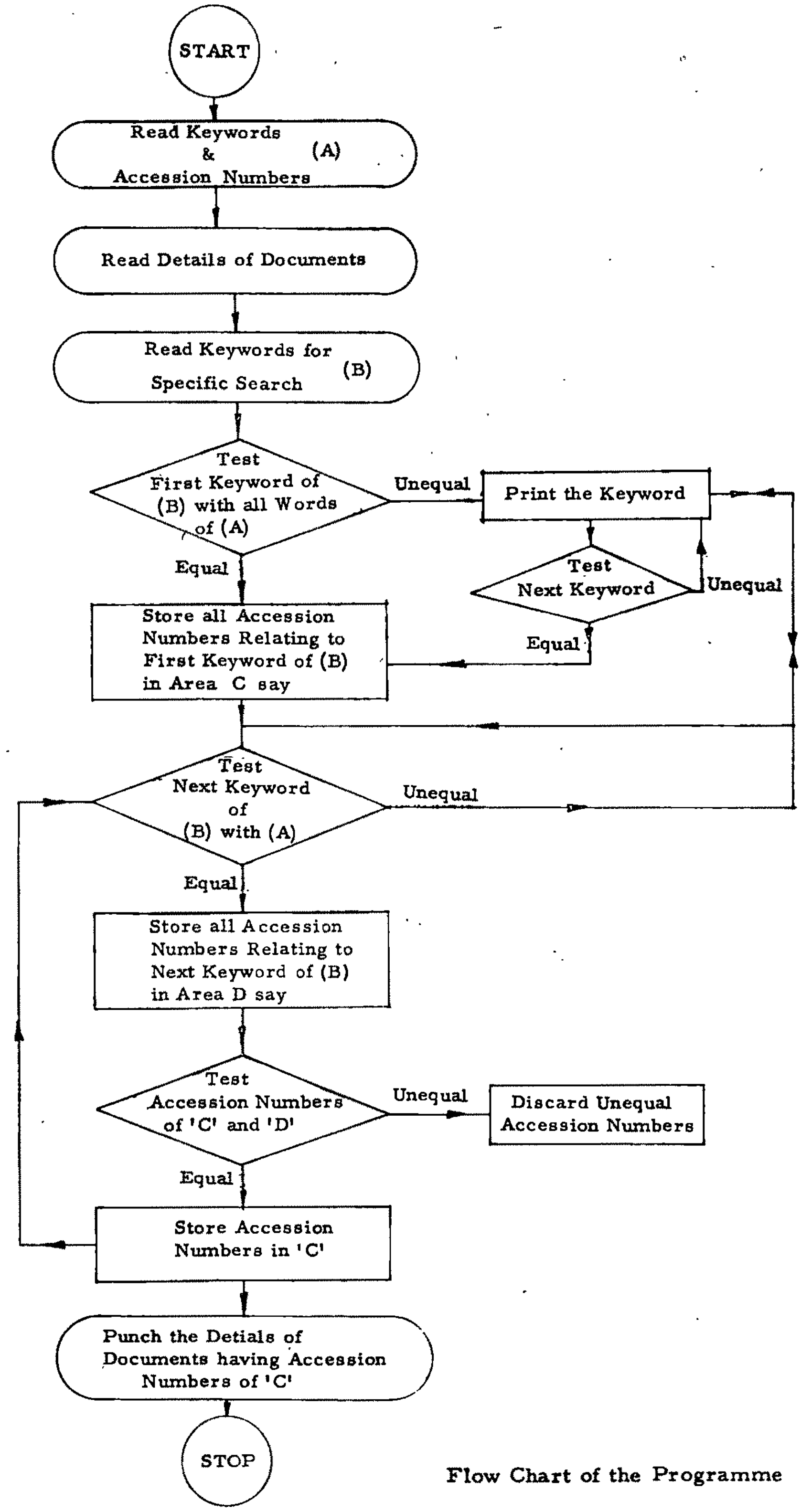
[Continued]

```
60     IA=IB+1
       KKYK=0
       GO TO (71,72),KK
71     READ 3,(SR(I),I=1,18)
       I=1
35     II=1
       KKKK=KKKK+1
       IF(SR(I))75,32,75
75     DO 30 J=1,L,3
       IA=I+2
       IB=J
       DO 7 IL=I,IA
       IF(SR(IL)-AA(IB))8,7,8
 7     IB=IB+1
 6     IJ=(J+2)/3
       JJ=II+ITN(IJ)-1
       IL=0
       DO 10 IK=II,JJ
       IL=IL+1

10     ISAC(IL)=IACC(IK)
       III=IL
       GO TO (16,17),K
16     DO 15 IB=1,III

15     ITAC(IB)=ISAC(IB)
       JJJ=III
       K=2
       GO TO 40
17     IL=0
       DO 20 KK=1,III
       IL=IL+1
       IMM=0
       DO 21 LL=1,JJJ
       IMM=IMM+1
       IF(ISAC(KK)-ITAC(LL))25,23,25
23     ISAC(IL)=ISAC(KK)
       GO TO 20
25     IF(IMM-JJJ)21,24,21
24     IL=IL-1

21     CONTINUE
20     CONTINUE
       JJJ=IL
       IK=JJJ
       DO 19 IJ=1,JJJ
19     ITAC(IJ)=ISAC(IJ)
       GO TO 40
 8     IJ=(J+2)/3
       II=II+ITN(IJ)
30     CONTINUE
       PRINT3,(SR(IL),IL=I,IA)
40     I=I+3
       GO TO 35
32     J=1
       IF(JJJ-1)50,48,50
50     MIN=ITAC(1)
       II=1
       DO 45 I=2,JJJ
       IF(MIN-ITAC(I))45,45,43
43     MIN=ITAC(I)
       II=I
45     CONTINUE
       ISAC(J)=MIN
       IF(II-JJJ)46,47,46
46     ITAC(II)=ITAC(JJJ)
47     JJJ=JJJ-1
       J=J+1
       IF(JJJ-1)48,48,50
48     ISAC(J)=ITAC(JJJ)
72     DO 80 I=1,M
       IF(IAN(I)-ISAC(JA))80,66,80
66     IB=35*I
       IA=IB-34
       PUNCH 62,IAN(I),(DETL(J),J=IA,IB)
       JA=JA+1
80     CONTINUE
       KK=2
       IF(SENSE SWITCH 1)69,70
 1     FORMAT(I4)
 3     FORMAT(18A4)
 4     FORMAT(3A4,I4,(14I4))
61     FORMAT(I4,17A4/18A4)
62     FORMAT(I4/7A4/4X16A4/4X12A4)
       END
```


START
Read Keywords & Accession Numbers (A)
Read Details of Documents
Read Keywords for Specific Search (B)
Test First Keyword of (B) with all Words of (A)
Unequal
Print the Keyword
Test Next Keyword
Unequal
Equal
Equal
Store all Accession Numbers Relating to First Keyword of (B) in Area C say
Test Next Keyword of (B) with (A)
Unequal
Equal
Store all Accession Numbers Relating to Next Keyword of (B) in Area D say
Test Accession Numbers of 'C' and 'D'
Unequal
Discard Unequal Accession Numbers
Equal
Store Accession Numbers in 'C'
Punch the Detials of Documents having Accession Numbers of 'C'
STOP

Flow Chart of the Programme

LIST OF PERIODICALS COVERED IN THIS ISSUE

Note: Volume and issue numbers have been mentioned in each case.

ALA Bulletin [ALA Bull]	61(1,2)
ASLIB Proceedings [ASLIB Proc]	19(1,2,3,4)
Australian Library Journal [Aust Lib J]	16(1,2)
Biblos [Biblos Vienna]	15(3)
Bookmark [Bookmark]	26(4)
College and Research Libraries [Coll Res Libs]	28(2)
Computers and Automation [Computers Automn]	15(8)
Data Processing [Data processing Lond]	8(6)
Dokumentation Fachbilliothek Werksbucherei [Doc Fach Werksbuch]	14(1)
Education Libraries Bulletin [Educ Libs Bull]	1967(28)
Harvard Library Bulletin [Harvard Lib Bull]	15(1)
Herald of Library Science [Herald Lib Sci]	5(4); 6(1)
Indian Librarian [Indian Libn]	21(4); 22(1)
Information and Control	9(5)
Information and Documentation [Inf Doc Japan]	9(3)
Information Storage and Retrieval [Inf Stor Retr]	3(2)
Journal of Chemical Documentation [J Chem Doc]	6(4); 7(1)
Journal of Documentation [J Doc]	22(4); 23(1)
Journal of Education for Librarianship [J Educ Librnship]	7(2)
Journal of Library History [J Lib Hist]	2(1)
Knihovnik [Knihovnik]	11(1,2,3,4,5,8,10)
Leabharlann [Leabharlann]	25(1)
Library Association Record [Lib Ass Rec]	69(1,2,4)
Library Journal [Lib J]	92(1,2)
Library Quarterly [Lib Quart]	36(2,4)
Library Resources and Technical Services [Lib Resources Tech Serv]	11(1)
Library Science with a slant to Documentation [Lib Sci Slant Doc]	4(1)
Library Trends [Lib Trends]	15(2)
Medical Library Association Bulletin [Med Lib Ass Bull]	55(1)
New Zealand Libraries [New Zealand Libs]	30(1)
Quarterly Journal of the Library of Congress [Quart J Lib Congress]	24(1)
Quill [Quill]	8(1)
Reproduction Review [Reprod Rev]	16(9)
Special Libraries [Spec Libs]	58(1)
Unesco Bulletin for Libraries [Unesco Bull Libs]	20(5)
Wilson Library Bulletin [Wilson Lib Bull]	4(2,5)

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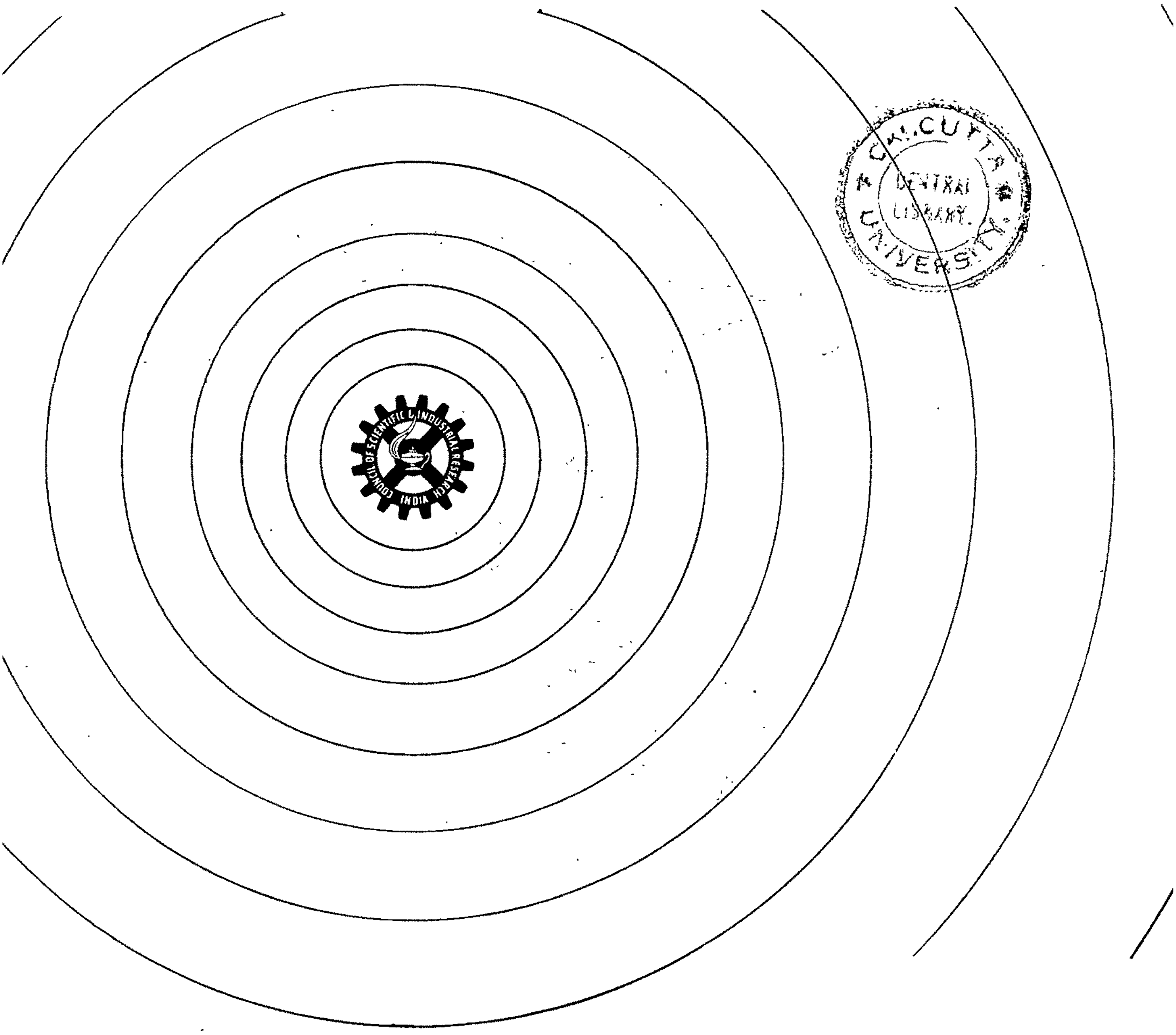

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SELECTIVE INFORMATION DISSEMINATION AT NATIONAL AND GENERAL LEVEL

CALCUTTA UNIVERSITY CENTRAL LIBRARY

I POLZOVICS

Hungarian Central Tecbnical Library and Documentation Centre, Budapest.

The origin, growth and the mechanics of the Hungarian 'current subject information' service are discussed. Though essentially the service aims to disseminate selective information keeping in view the users' needs, yet the maintenance of the users' profiles and the matching are not done mechanically as in a S.D.I. system. It is claimed that it is a 'made to measure' activity and human intervention in the selection is necessary to ensure 'precision'.

ORIGIN OF THE KWIC AND SDI

Since an ingenious engineer of IBM, the late H.P. Luhn adapted the data processing computers by the elaboration of various operational programs to documentary processing work without, or with a minimum of human cooperation, a wide perspective has been opened before us for the introduction of new types of documentation services. One of the first results was the current publication of the rapidly machine computed KWIC indexes, whose principle was worked out by Luhn in the middle of the 1950's and was demonstrated in the preparation of a machine produced index to the Scientific Conference on Information in Washington in 1958 [1]. Of the practical applications in the wake of the idea should be mentioned Chemical Titles [2] which is published in a somewhat modified version by the Editor of Chemical Abstracts and which in our opinion is the most successful representative of its kind [3].

Another possibility of mechanized documentation processing was also worked out by Luhn at the end of the 1950's as a selective dissemination of information or SDI system [4]. Though perhaps this system is not quite as ingenious, and does not dispense with the use of human labour to the same degree, as does the KWIC system, yet, it offers the possibility of realizing on a national level the dissemination of information on current literature which, so far, only the documentation centres of some institutes and enterprises or specialized libraries could provide in certain narrower fields to their employees. With the SDI system on the other hand it seems possible to supply those who seek information on certain definite subjects, defined by them, with information addressed to them personally on the current literature of their subject. Thus the person who receives this information is saved the trouble of following up his chosen subject in the huge mass of the abstracting journals or other documentation services. From the point of view of the user the advantages of the system are obvious and it would therefore have been justified on the side of larger documentation institutions to introduce the system immediately after its becoming known, or at least to experiment with this system in the way as it has been done with the KWIC index. Interestingly enough, so far, we have no knowledge about the application of the system on a nation-wide level for broad specialized fields in the United States; only some large firms e.g. Douglas Aircraft Company, General Electric Company, Evendale Minnesota Society are known to provide to their staff and departments selective information by the machine method on the current literature of certain subjects. The American Society for Metals also supplies its members with machine processed selective information in metallurgy [5].

SDI AT NATIONAL LEVEL

Recently some news came to our knowledge about national and even international experiment in documentation which will be undertaken after three years of preliminary experimenting in Great Britain by the National Electronics Research Council (NERC) to machine process and disseminate current literature on electronics published in English

[6]. The Earl Mountbatten of Burma discussed in a highly interesting essay the problems of 'information explosion' which in his opinion may be counteracted by the newly envisaged selective dissemination of information system [7]. The importance of the role attached to the system appears also from the fact that the illustrious author discussed the importance of the system with A.N. Kosygin the Prime Minister of the Soviet Union.

THE HUNGARIAN SYSTEM

Considering this extraordinary attention and great expectations which the SDI system has aroused, we believe that the following brief report on the results and experiences of a documentation system based on an essentially same conception will not be uninteresting. This system has been in operation in Hungary since 1955 on a national level for the entire field of technology and related basic sciences and extends to the processing and dissemination of current literature published in about 20 languages. It should be noted right at the beginning that our system is not yet mechanized but nevertheless works with relatively high capacity and efficiency. It should remembered, as noted by the Earl Mountbatten, that such a system should be judged not on the merits of its mechanized effectuation, but on its principle of operation, which is the same for both the systems.

The introduction of the selective information system on a national level in Hungary in the middle of the 1950's was due to similar reasons as have induced its introduction now in Great Britain — to meet in a differentiated manner the requirements of the users and to save them searching in the documentation services providing mass information. Besides the abstracting journals dealing with the entire field of technology we had also at our disposal a fairly differentiated card service from which current information could be ordered on about 1200 subjects classified according to the UDC. This service alone was already to some degree a selective way of information dissemination. Nevertheless, we have found that not even this service meets satisfactorily the special requirements of research and technical development, as the subject groups are relatively extensive and the research worker has to search for the literature of his special subject in a mass of the material received. Furthermore, literature of a certain subject may have been classified into another subject group because of the complexity of the subject or the alternative classification possibility of the UDC, when it may evade the attention of the searcher, unless he subscribes to all the possible subject groups into which is particular subject might have been classified. Thus even with our highly differentiated classification system the card service offers partly more and partly less than is necessary for an individual for following up the literature of his special subject.

To eliminate these disadvantages we devised and implemented as far back as 1955 an information processing and dissemination system which follows the literature of the subject in the same differentiation and subdivision as postulated by the user. Our service aimed to offer currently all that bibliographic search offers occasionally for any differentiated subject, when the user is not forced to select from a given list but may postulate and outline his own subject. Thus our service is essentially a current differentiated bibliographic search. We called it keeping in mind its essential feature as "current subject information"[8].

THE MECHANICS OF THE HUNGARIAN SERVICE

Our subject information service — as we have come to realize — is essentially identical with selective dissemination of information without machine processing. In our system, as in the SDI, the subject is set by the user. It has also the common feature with SDI that on receipt from the user the subject has mostly to be re-drafted to find a more accurate expression which differentiates it from other subjects. However we do not go as far as the planned NERC system [6] which subdivides the subject of the user into several uniterms and provides information through these essentially transformed subject words. This is necessary in the SDI system for machine processing, but as we in Hungary have no computer service as yet this subdivision into several uniterms was superfluous. It was also superfluous because our subject information does not provide for comprehensive subjects e.g. cybernetics, computers, automation, radar systems etc, as requests of this type can be met by the card service mentioned earlier. Subject information is decidedly meant for following up the literature of differentiated subjects between the limits set by the user. Some of our differentiated subjects from the field which will be covered by NERC, quoting from our practice, are: Cathode and heating systems of electron valves; Electron optics of cathode rays; Stereo signal generator; Analogue digital transformers; Heating and cooling of electronic equipment etc.

The literature of these differentiated subjects is followed up by our subject information service in the primary literature which is abstracted for our journals from about 2200 foreign and 80 Hungarian journals and periodicals. The outside abstractors, of whom there are about 500, receive a list of the subjects included in the "subject information service" and note on the manuscript of the abstract the subject to which it refers. If the entire publication does not deal with the subject the abstractor makes a note of the pertaining chapters or pages. As in the abstracting journals about 25,000 longer and a very large number of shorter communications are published monthly, the base of the service is very broad.

As, however, the following up of a subject in this manner would entirely be left to one person, i.e. to the memory of the person, and would be complete only in as far as the person is capable of doing thorough work, the subject notations are twice revised by the internal staff of the Hungarian Central Technical Library and Documentation Centre. Revision is both in the positive and in the negative direction, the superviser complements from the text of the abstract subjects not noted, while in the negative sense he delates notations which were wrongly supplied by the abstractor, in case neither the title nor the abstract indicates any substantial connection with the subject noted. About 15 full-time documentalists also otherwise engaged, mainly engineers and some economists, take part in this work.

DIFFERENCE BETWEEN THE SDI AND THE HUNGARIAN SYSTEM

It is obvious from what had been said so far that the selective information dissemination system as practiced by us is somewhat different, with respect to methods and individual execution, from the data processing by machine in the SDI system. In our case special attention is devoted to each subject during abstracting and relevance is judged fundamentally on the direct inspection and evaluation of primary literature. Only during supervision, the results of documentational processing i.e. title, secondary content of the abstracts are used and a relation established between the latter and the subject. Thus in this differentiated service the process is not the same as in the card service mentioned, or as in the SDI system, in which individual documentation descriptions receive classification signals by the UDC classification system or by a subject word thesaurus often embracing entire fields of a special science. In such systems, in case the subject words agree with the request, the processed literature is automatically directed to the user. The subjects on which we provide information are of different nature. Far from covering an entire special field, they cast light only on some specific problems of the field. Thus following up these special subjects is not a mass work like the classification of the information material obtained by abstracting according to some thesaurus, but, in fact, is a "made to measure" activity which is adapted to the differentiated requirements of each individual user and his subject, and satisfies him with "precision" information.

ERRORS IN SELECTIVE INFORMATION

It follows from the aforesaid that in this abstracting, processing and dissemination activity the types of errors as mentioned by the Earl Mountbatten will not appear in the same proportion as in the SDI system. Firstly, in our case the pool of literature data is not much wider than the amount of disseminated data. Because during abstracting the requirements of the service were borne in mind, thus the sought smaller fraction is not selected by classification from a large mass of information, but a selected material is made to conform with the requirements by repeated supervision. Because of double supervision, errors in the "noise" group is very few. This figure may reach in actual practice to 2-3 per cent because due to some reasons the information in the referred literature may be of no value to the user. It may be that the information is not new, is not sufficiently detailed, demands other application conditions etc. The "misses" group is also different in many respects and due to three fold revision only a relatively small fraction is likely to be missed. A greater problem is raised by a few items out of about 25,000 current monthly communications whose link with the subject could not be established from the contents by the abstractor, though the title might have referred to it, or he failed to abstract it. From this point of view the "misses" group may be considerably larger.

These shortcomings are however the necessary ancillaries of documentational work and more so when we are dealing with "precision", "made to measure" work. We should of course aim at reducing the percentage of both the "noise" and the "misses" group of errors to the humanly possible lowest level, but because of the finite nature of human attention they will never be completely eliminated, while in the case of machine processing they are necessary concomitants of the mechanism and may reach 20-50 per cent. Levery emphasized that in the experimental machine produced index the noise was only 20 per cent [9].

GROWTH AND PRESENT POSITION

After having given a brief survey of the methodology and operational principle of the differentiated Hungarian system of selective information dissemination on the national level and of general applicability, and having noted its common features with the mechanized SDI system, we shall finally attempt to survey the practical functioning of our subject information service and illustrate this with some characteristic data. As already mentioned the system had been introduced into the documentation service of the Hungarian Central Technical Library and Documentation Centre in 1955. The system was initiated, its methodology worked out and introduced into practice by the author of this paper. Even during its six months trial period the service covered the whole field of technology and the allied sciences like physics and chemistry and culled information from journals and periodicals published in about 20 languages. In the first experimental year, part of 1955, 75 mainly heavy industrial enterprises asked for about 340 subjects. It is obviously due to the results of this service that in the course of years, as no special propaganda except a few circulars was made to boost the service, more and more enterprises and institutions joined the users with increasingly more subjects. So much so that because of the limitations of our apparatus, in the last 2-3 years the number of subjects had to be limited. The fact that the orders come from enterprises and institutions means that the user is practically never a single person, but several employees, so that we may calculate an average of five users for each order. In 1966, 550 enterprises and institutions were on the list of our subscribers, which means that probably about 2700 persons benefitted from the service. There were at the same time 1447 subjects ordered, which belonged to the following fields:

	No. of subjects
Mathematics	9
Physics	24
Chemistry	26
Biology	8
Chemical Industry	129
Electrotechnics	94
Telecommunication, Electronics	117
Instrumentation, Instruments	124
Machine Industry	160
Metallurgy	126
Mining	94
Energetics	85
Textile Industry	88
Food Industry	78
Wood Industry	16
Paper Industry	10
Packaging	12
Building Industry	34
Building Material Industry	26
Civil Engineering	33
Communication	99
Safety maintenance	9
Economic Policy	28
Agriculture	11
Documentation	7
Total	1447

As some subjects were ordered by several of our subscribers, on an average one subject was ordered by 20 subscribers, about 32,300 subscriptions were received for the subjects in 1966. On an average one subscriber ordered 58 subjects. This led to the collection of a total of 87,600 references on the 1447 subjects, corresponding to a monthly average of 6 reference per subject. Because of multiple orders the service disseminated more than 1,700,000 references to its subscribers in 1966.

Most of the disseminated information were in abstract form on typed or duplicated sheets (DIN A5 size), collected and sent out monthly. The subject information sheet shows the title of the subject, with full bibliographic data, provided mostly with abstracts, of the references. Two full-time and five part-time workers attend to the administrative work. Duplicating is carried out in the printing shop of the Documentation Centre and the forms which serve for duplication are typed by outside typists. The group leader is a university graduate who, together with a staff member with engineering degree and three outside specialists, performs the second revision and the editing of the information material of each subject.

The double revision, completion, correction, arrangement, editing, copying i.e. duplicating and posting to subscribers the collected material of the abstracts received from the outside abstractors takes an average of two months without any machine help. If to this the average of one month needed for abstracting and the first notation of the subject is added then the subscriber receives information on his subject in about three months after the arrival of the foreign journals. This time requirement might be reduced by a fortnight by fortnightly mailings, but without mechanization of the processes no further acceleration can be expected. We believe that only some part-processes should be mechanized in our case, because the elaboration of the literature of the differentiated subjects requires considerable human work which is an absolute prerequisite for the quality of our service and excludes the possibility of complete mechanization in the form of the SDI system.

With respect to the economic aspect, because of the multiple use of the subjects, the service has been for years self-supporting in spite of the very low subscription fees, moreover it covers the expenses of the outside abstracting of about 110,000 items which are used also in our abstracting journals and card services.

Our service enjoys a widespread reputation and popularity among the Hungarian institutions and experts engaged in research and technical development. Though we have omitted the so-called feed-back, as we do not wish to burden our subscribers, the effective utilization of the information service is indicated by the volume of translations ordered from our institution. Translations ordered on the basis of this information service exceeded by 40 per cent the translations ordered from our most extensive documentation service, namely our 13 abstracting journals. In 1966 about 5800 translations, covering a total of approximately 80,000 typed pages were ordered and posted.

It should be finally mentioned that the not mechanized subject information system of the Hungarian Technical Library and Documentation Centre has been adopted by the Scientific Documentation Institute of the Rumanian Academy of Sciences and, as we have learned recently, has been used with success since 1965 after an adjustment to their particular needs.

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SOME NEW TERMS IN DOCUMENTATION AND A GLOSSARY OF ACRONYMS

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The recent rapid growth of new terms in documentation is discussed. It is held that they are mainly due to the interdisciplinary nature of documentation and information retrieval field, and the current active phase of machine application in this field. A glossary of about 60 terms, mostly names of retrieval systems, are presented bringing out their salient features. References have also been added for each of the items.

A Traditionalist's Choler

Reading is very often a hurdle race
When one happens to start with GRACE

    Soon stumbles on CCF, PCF and MEDLARS
    But he aspires to be amidst scholars

So he continues still, and if not dizzy
Before long he has to be really busy

    Getting to know what is ALP and ALPHA
    And that is not all as he comes on ASCA

Attempts to find needle in haystack
Takes him only before a real HAYSTAQ

    Three sweet names ALGOL, COBOL, SYNTOL
    Are they three sisters, pretty and tall?

When he gets 'SURF uses MADAM' in a page
It is as if he stops before a haze

    Only he can pity the unknown madam
    Before deciding finally to abandon

God help him from such cruel wordiness
Documentation literature is in utter mess.

[Inspired by 'Scholar's Choler' by Jane Apostol]

Indeed, documentation literature has, in recent years, been invested with such unfamiliar, at times quite intriguing, terms and expressions that for a traditionalist librarian it is often difficult to follow and understand current literature. This luxuriant growth of new terms are, we believe, mainly due to the interdisciplinary nature of documentation and information retrieval field, and the current active phase of machine application in this field. Designing of systems for information storage and retrieval has become the common subject of investigation by many diverse groups during the last few years. Librarians, who were the earliest, have been joined in this field by documentalists, mathematicians, system designers, equipment manufacturers, operation researchers, computer programmers and scientists in increasing numbers. The presence of so many workers, in the same field, with different backgrounds, capabilities and views is bound to create some communication problems, as each worker is to some extent unfamiliar with the others' language. That is exactly why no research area has so soon needed a glossary of terminology in use. What is more important is that this glossary needs to be constantly revised augmented and kept up-to-date. This is one aspect of the picture.

The other aspect is the application of machines in information problems. Since the end of the last world war, computers, photographic processes, and magnetic recordings have been holding out, in a very tantalizing way, the prospect of solving many problems of information storage and retrieval. From a period of optimistic and fanciful claims and promises, when we had such magic name like MEMEX, we have now come to a phase of more careful and purposeful thinking. This has meant actually a close study of the characteristics of the data processing machines and reprographic equipment, on the one hand, and the nature and mechanics of the whole process of information storage and retrieval on the other.

Surely, two basic characteristics of these machines are that they are both unintelligent and expensive, and both have deep implications. Because a machine is unintelligent it has to be told not only what exactly is wanted but also what is to be done to get it. Again, all these will have to be told in a language which will be intelligible to the machine. This complicated business has meant analysing the whole process of information retrieval i.e. classification, or grouping the documents on the basis of their information content and appropriately tagging with codes, on the one hand, and analysing the requests, on the other hand, and then matching the two to find the relevant documents. This is not at all a new process. Librarians too have been following a similar process. While adding a new publication to a collection, cataloguers and classifiers keep in mind the probable users and their ways of approach and accordingly tag it under a subject group (with Class number) and choose suitable headings for the catalogue. When this same process is analysed by a different group of people with different background and a system is designed for machine retrieval, we get such expressions as, hit, recall ratio, noise, users profile, selective dissemination of information or simply SDI and so on. In course of time we get such expression as 'in any SDI system, maintenance of accurate users' profile and facility to adjust it to alter the level of match are the most important prerequisites'.

The second characteristic of data processing machines, as we have mentioned, is that they are expensive. This too has one important implication. This means that unless the entire cycle of information generation, storage and retrieval is considered together, machine application will not be economically viable. In other words it means that a systems approach is necessary, as any piecemeal work will be too expensive. With the realisation of this fact many attempts are now being made to design and operate mechanised systems which will take care of the entire bibliographical needs of subject-communities. There is a marked tendency to christen such systems with affectionate acronyms or initionyms. So, we have today MEDLARS, INTREX, ABLE and many more.

There is still another source for the generation of new terms. Probably, very soon, we will be facing the cumulative effect of the new terminology, as a new term is coined, that itself may be used as a stem for further culture to generate a few variants or new terms. Thus using KWIC as a stem we can coin Kwicable, an expression which has already come into us.

All these explain, in brief, how and why new terms are coined and put into use, and it promises also many such new terms in the future. The difficulties of a traditionalist facing such semantic hurdles and also his joy and delight, if he is able to get over these hurdles are very clearly expressed by William H. Carlson in the following passage:

> "Uniterm, bits, symbols, KWIC, Zato coding, auto encoding, descriptors... CRAM, Minicard, Magnacard, ... FLIP, FOSDIC, Filmorex, ILAS... HAYSTAQ, Termatrex, Verac, WALNUT — these and many, many other terms, for the most part newly coined, probably with some pride of authorship, have come crowding into the literature and discussion, to the confusion of traditionalists like myself. Through the strange miasma and fog and pounding surf of semantic noise steadily swirling and growing I still perceive, nevertheless, the old familiar coast, capes, headlands, rocky shoals, and light houses" [1]

The last sentence is very significant, as we think it assures all traditionalists, specially those like us, who are unfortunately far removed from the main arena of these new experimentations, that there are many things which are familiar to the conventionalists in these new experimentations. Carlson further assures that traditional indexing, cataloguing and classification systems have been improvised, improved and perfected by devoted men like Dewey, Ranganathan, Martel and Hanson. Machine control of literature will also need its Deweys, Ranganathans, Hansons and Martels. Perhaps they are already at work now. If that is so, every traditionalist, we are sure, would like to know and understand their work.

This paper with short annotations on some of the major systems (specially with acronymous names) will, it is hoped, be helpful for a traditionalist to get some idea of the recent developments, and can be supplemented by reference to the bibliographical sources mentioned at the end of each item. We have selected such references which are easily available. We have not tried to prepare a comprehensive glossary of such terms, but our endeavour has been to pick out and explain only a selection of them and present them in a form which can be easily read through.

REFERENCES

1. Carlson, William H: The Holy Grail evades the search. Amer Doc, 1963, 14(3), 207-12.

2. Bourne, Charles P: Methods of information handling. New York, John Wiley, 1963.

3. Current Research and Development in Scientific Documentation. National Science Foundation. No. 13, 14, 1964, 1966, (NSF-64-17, NSF-66-17) (Abbreviated as CRDSD).

4. Nonconventional technical information systems in current use. No. 3, 4, 1962, 1966 (NSF-62-34, NSF-66-24).

GLOSSARY

ABC (Approach By Concept): A storage and retrieval system recently developed by the Harry Diamond Laboratories, Washington to meet the specific information needs of the scientists and engineers of the organisation engaged in the production of new electronic and electrochemical systems, subsystems, and devices. In this system, all documents are evaluated, the selected documents are described in verbless sentences or strings of phrases, called descriptor sentences. Printouts, arranging these descriptor sentences into a KWIC type dictionary with accession codes are obtained. This dictionary allows a user the facility of "browsability". The retrieval can be performed automatically or manually after consultation of the dictionary. If a computer output is preferred, the machine can be programmed to print out all the titles filed under the selected descriptors or their respective codes.

[Altonann, Berthold: A natural language storage and retrieval (ABC) method, its rationale, operation, and further development program. J chem Doc 1966, 6(3), 154-57. 3 ref.]

ABCD (Abbott Biological and Chemical Data): A system for storage and retrieval of biological and chemical data by means of machine readable tab cards and magnetic tape. It is in operation since 1959 at the Abbott Laboratories, Chicago. Documents are stored in the form of full-size copy or roll microfilm. Indexing characteristics used are subject or concept terms, headings or descriptors, molecular or structural formulae, biological, chemical or physical properties; project name or number, and accession number.

[Nonconventional scientific and technical information systems in current use, No. 4, p. 239]

ABLE (Agricultural Biological Literature Exploitation): A mechanized system under study and development at the National Agricultural Library (U.S., Dept. of Agriculture). Possible areas of automation are: Author Index for Bibliography of Agriculture (already started), addition of a monthly subject index, production of the annual index for the Bibliography of Agriculture, catalog card preparation including a machine readable record for producing other products, production of Titles Indexes in the Bibliography of Agriculture, update Subject Authority List, Selective Dissemination of Information system to include a customized title Service by Journal and permuted Title index according to user profile, complete production of Bibliography of Agriculture, producing records to be used later in an information retrieval system, Title received by NAL, Current serial records, and Research Project files. Some preliminary studies on some of these activities have already been done.

[U.S., National Agricultural Library: Agricultural Biological Literature Exploitation - Report of Task Force. 1965, p. 477]

ACORN (Associative Content Retrieval Network): The Arthur D. Little, Inc. has been investigating the degree of centralization which should be planned in designing documentation retrieval mechanisms best suited to the needs. As a part of this investigation, several experimental network devices have been built. One of them enables associative network identification of technical information centres in the area of Political Science, according to the subjects with which these information centres deal. This device is an ACORN, a simple analogue information processing device which performs a fairly complex highly-parallel information processing function.

[CRDSD, No. 13, p. 59]

ALP (Automated Library Program): The Datatrol Corporation has developed this system which is designed for the IBM1401 computer. The speciality of the system is that it can accept almost any vocabulary, record format, and degree of indexing sophistication. It permits simultaneous multiple searches; optional use of links, roles, subject categories, and indexer's or searcher's weighting of terms; and the automatic arrangement of output in the order of probable relevance.

[CRDSD, No. 13, p. 83]

ALPHA (Automated Literature Processing, Handling, and Analysis) System: The system is under development at the Redstone Scientific Information Centre, Alabama. The project is aimed to develop a single automated system of performing the maximum number of scientific and technical library functions as an integrated whole. Under its perview comes advanced information retrieval, current awarness services, retrospective inquiry, circulation control, ordering, receiving, and general management processes.

[CRDSD, No. 14, p. 356]

ASCA (Automatic Subject Citation Alert): This a selective dissemination of information (SDI) service provided by the Institute for Scientific Information, Philadelphia. In this system, each scientist or organization submits a profile of interest by citing about 50 articles or keywords. The profile is used in the ASCA computer system to select, on a weekly basis, the pertinent literature currently appearing in over 1400 journals which publish about 250,000 items per year. A printout, in the style of Science Citation Index, indicating the articles and their sources where any of the articles from a client's profile is cited, is sent to the clients.

[Garfield, Eugene: ISI services in the design of small-user systems. J chem Doc 1966, 6(3), 164-68. 8 ref]

BRAID (Bidirectional Reference Array, Internally Derived): A technique for using large-scale random-access computers to search complete text, under investigation at the Datatrol Corporation. The technique also shows promise for use in chemical structure search. The speciality of BRAID lies in its capability to eliminate redundancy, which is made possible by the substitution of computer addresses for actual words or phrases, permitting the storage of a complete bidirectional concordance.

[CRDSD, No. 13, p. 84]

ChemSEARCH (Chemicals Selected for Equal, Analogous, or Related Character): Developed at the Colgate-Palmolive Research Center, New Brunswick. This is essentially a mechanized system for handling documents relating to chemical and biological activity in relation to chemical structure. Hence, at the input stage, stress is given on the complete representation of the molecule, atom by atom, in a structural formula. This has its strength in the chemist's familiarity with structure. The input is through paper-tape-punching typewriter. When a search is made through the Question Reader program the question is made in the form of a 'question structure' and the computer makes a comparison of the question structure with the file structures.

[Gould, David, Gasser, Edward B and Rian, John F: ChemSEARCH - an operating computer system for retrieving chemicals selected for equal, analogous, or related character. J chem Doc 1965, 5(1), 24-32]

CITIS (Centralized Integrated Technical Information System): CITIS builds a model in which linear programming methdology is applied to the information sciences field. The CITIS contribution to the area of centralized integrated technical information systems is to provide the information center manager with the vehicle to utilize developments within the "Information Sciences" and to better manage the information center operation. The CITIS Model 1 illustrates the key summary resource allocation relationships that are necessary for the effective development of a "centralized-decentralization" operation for a technical or a scientific information center.

[Podell, H. J.: CITIS, a generalized mathematical model for a centralized integrated technical information system, from a resource allocation point of view. American Documentation Institute, Annual Meeting, 27th, 1964, Proceedings. 155-72]

COMEINDORS (Composite Mechanized Information and Document Retrieval System): Developed at U.S. Army Biological Laboratories, Fart Ketrick, Frederick, Maryland. A semi-mechanized information and document retrieval system. This system uses a "pure decimal" notation; in one or another manner, the classification resembles the categories of Roget, the ASTIA thesaurus, the codes of Dewey, the arrays and chains of Ranganathan, and the faceted classification of Vickery. Dewey's zero is extended to serve as a code marker for categories that are, or may be, divided into more specific terms. One of the chief components of COMEINDORS is a series of lattice-type classification forms that simplify and expedite the development and control of the ordered classification of terms.

[Batchelor, H.W. & Maloney, C.J.: A Mechanized information and document retrieval system. J chem Doc 1964, 4(3), 181-5]

COMIT: This is the name given to the MIT computer programming language for mechanical translation. The programming language is quite different from others because of its different purpose. The language is designed to give the linquist direct access to the computer without his having to concern himself with details that are irrelevant to his problem. The language is being provided with a compiler and interpretative routine written for the IBM 704 computer.

[Yngve, V.H: The COMIT system for mechanical translation. (In Information Processing - Proc. int. Conf. Inform. Processing, Unesco, Paris, 1959. London, Butterworths, 1960. pp. 183-87)]

CRIS (Command Retrieval Information System): Developed in 1962 by a subsidiary of Information for Industry, is an outgrowth of some earlier work done by Avatcian* in 1956. This system stores images photographically on a scroll of microfilm 400 feet long by 17 inches wide; each scroll contains over 500,000 page-size images or over 28,000 large drawings. A keyboard device is used to enter a CRIS address, and the image at that address is displayed to the operator or is provided in aperture card form. The average time to retrieve any desired image is under 20 seconds, and the retrieval time for sequential images is even faster. The scroll material is a Mylar base with a Kalfax emulsion and is usually prepared by contact printing from strips of microfilm that were obtained by conventional procedures.

[Larson, P.W.: CRIS (Command Retrieval Information System) Proc 11th Annual Convention of the National Microfilm Association, pp. 41-50 (National Microfilm Association, Annapolis, Maryland, 1962). CRDSD No. 13, p. 247]

DACOM (Datascope Computer Output Microfilmex): Translates computer language on magnetic tape to human language on microfilm. It includes five basic, interrelated sub-systems: 1) The input by means of magnetic tapes; 2) The character generator, using a glass plate with a capacity of 64 characters; 3) a display tube; 4) on-demand 16 mm camera; and 5) the logic and control sub-system. DACOM can create pages of alpha-numeric data, and has also available three other modes: plot mode, axis generator mode, and vector generation mode. Information written on eight or more reels of 2,400 foot magnetic tape can be recorded on 100 feet of Dacom microfilm.

[Effros, A.L.: The Recordak Dacom system. New York, 1961, p. 5. (Paper presented at the Symposium on Information Processing of the Los Angeles Chapter, American Documentation Institute, September 29, 1961)]

FAIR (Fast Access Information Retrieval): This is a research project based at MRC Laboratories, Holly Hill, Hampstead, London and is being financed by the Medical Research Council. The aims of FAIR are: (i) to produce a formula for creating efficient indexes to feature-card (also known as 'peek-a-boo') information retrieval systems; (ii) to explore the possibilities of members of a learned society helping in the setting up of an information retrieval system for their own use, and (iii) to test the practicability of providing a whole library on the individual's desk. Subject to copyright arrangements the whole collection may be microfilmed and a copy made available to each satellite, where there would need to be a microfilm reader or reader-printer.

[Morton, Leslie T: Notes from London. Bull med Lib Ass 1966, 54(3), 255-56.
Pickford, A.G.A: FAIR (Fast Access Information Retrieval) Project; aims and methods. Aslib Proc 1967, 19(3), 79-92]

FLIP (Film Library Instantaneons Presentation): This is a photographic film reading machine developed by Bensen-Lehner Corporation. The machine is able to search for a particular frame on 16 mm film at a speed of 300 to 600 frames per second, then present this frame for viewing to the operator. Each frame contains pictorial data and binary coded information. The quipment for the operator consists essentially of a keyboard interrogation device, and a large display screen. The keyboard positions correspond to the coding positions on the film so that the inquiry can be keyed into the system via the keyboard.

[Worsley, Peter K: Data retrieval with special application to use of Film Library Instantaneous Presentation (FLIP) in literature searching. (In Boaz, Martha, ed. Modern trends in documentation. Oxford, Pergamon Press, 1961, p.70)]

GREMAS (Generic Retrieval by Magnetic Tape Storage): Work on the system is going on at the Farbwerke Hoechst AG, vormals Meister Lucius & Bruning, Frankfurt since 1955. It is adapted for literature on organic chemistry. Organic chemical compounds and their reactions are classified according to the principles of analytico-synthetic classification and the notations based on this classification are used by computer for storage and retrieval. At present more than 150,000 structural formulae of organic chemical compounds and of groups of compounds have been stored as well as several thousand organic chemical reactions. IBM705 and IBM1401 are used and 32 different machine programmes are in operation for storage and retrieval.

[Fugmann, Robert: Experiences with a faceted classification in organic chemistry using computers. (In Classification Research, Proc Int Study Conf, 2nd, 1964, Elsionore 341-67)]

HAYSTAQ (Have You Stated Answer to this Question): The system design and computer programs which make up the completed portion of the project to date are the result of collaborative efforts between the U.S. Patent Office and the National Bureau of Standards. The system is particularly designed to search chemical information for mechanizing patent search questions. The file to be searched is contained on a magnetic tape, and each entry in the file is an encoded chemical structure. Each structure is broken up into functional groups, with each such piece assigned a number known as its 'designation number'. HAYSTAQ executes a topological tracing among functional groups. The Hayward rules for chemical structure notation are being revised and expanded in order to simplify their application and widen their domain.

[Marden, Ethel C. and Koller, Herbert R: Present status of Project Haystaq p. 163 (In ICIREPAT, 3rd Annual Meeting, Vienna, 1963. Baltimore, Spartan Books, 1964).
Koller, Herbert R, Ethel C. Marden, and Harold Pfeffer: The HAYSTAQ System; past, present, and future. International Conference on Scientific Information, Washington, D.C., 1958. Proceedings 1959, Vol 2. pp. 1143-79]

IDEEA (Information and Data Exchange Experimental Activities): The objectives of the program, which is under the Department of Defense, are to establish an experimental test bed for the purpose of gathering live statistical data and the testing of advance data processing techniques. To effect maximum economy the existing militarized equipment, existing software packages, and the knowledge gained from several research projects in the military computer field are being utilized. The main equipment is the FADAC computer which is used as a computational module at several stations of the network. The next piece of equipment is a magnetic tape unit called "Tape Tub". The Gunnery Officers Console (GOC), a programmable switch, allows the computers to be interconnected to each other and to peripheral devices. Existing Data Transmission Link Equipment are used to give the network a wireless capability. All communications with the systems computers are made through the key-board of Army Chemical Typewriter (ACT) a three-shift punch-paper-type typewriter. In short, the IDEEA program represents a 'supermarket' of techniques that can form the basis for system decisions in terms of procedures, equipment, software, and communications.

[Hoffman, Allen: The Information and Data Exchange Experimental Activities (IDEEA) Program and its relation to the national interests. (In Towards a national information system – 2nd Annual National Colloquium on Information Retrieval, 1965. Washington, Spartan, 1965. p. 87-104)]

INTREX (Information Transfer Experiments): This is a four year programme at the Massachusetts Institute of Technology under Professor C.F.J. Overhage as Director. The objective of the experiments is to provide a design for evolution of a large university library into a new information transfer system that could become operational in the decade beginning in 1970. The project would establish a 'model library' on computer. This would consist of a collection (equivalent to about one million pages) of books, periodicals, abstracting and indexing services, items of non-book character, all falling broadly within one subject field. Fifty terminal stations or consoles are envisaged within a radius of about a mile on the campus which would give remote-access to the 'model library'. These would permit the transmission of the content of the documents as stored in machine-readable form for print-out at the terminals or for display on a tube and facsimile copying therefrom. It is proposed to organize the contents of whole groups of basic reference works so as to provide factual responses to questions, rather than references to works containing such responses.

[INTREX: Report of a Planning Conference on Information Experiments, ed. by C. F. J. Overhage and R. Joyce Harman. Woods Hole, Mass. 2 Aug - 3 Sept, 1965. Cambridge, MIT Press, 1965. p. 294]

KAPL (Knolls Atomic Power Laboratory): Services available from the system are: Retrospective searches, current awareness searches, notification abstracts, accession bulletins, computer-printed reference tools for manual search, and dissemination of microfiche to fill requests for permanent copies of any documents cited. Documents are indexed according to a classification schedule which may be described as a post-coordinated faceted classification scheme.

[Schmidt, C. J., R. P. Wesley and C. H. Hunter: KAPL's automated information retrieval system. Proc Amer Doc Inst Vol 1. Parameters of information science, Annual meeting, Philadelphia, 1964, pp. 177-64]

KWIC (Key-word-in-context) index: Usually we mean a permutation index based on titles and produced by machine. Best examples of this type of indexing are to be found in the 'Chemical titles' and the 'BASIC Index'. Although indexing by key-words, with meaning clarified by context was not new, yet the credit for developing the idea for machine adaptation and also coining this expression goes to Dr. H. P. Luhn of the IBM. The underlying principle is that all essential words can be extracted from the title, abstract, or text and can be used effectively. The context about a keyword helps to define or explain its use, in order to lead the index user to the exact article, paper, or other bit of information he desires. The principal merit of the method is timliness. That is why it is being used more and more in current awareness services or where time and resources are not available to prepare a conventional subject index. Some variations of KWIC are KWIT (Keyword-in-title), KWOC (Keyword-out-of context), and WADEX (Word and author index).

[Fischer, Marguerite: The KWIC index concept, a retrospective view. Amer Doc 1966, 17(2), 57-70]

LINCO (Linearly Organized Chemical Code for use in Computer Systems): Developed at the Shell Internationale Research Maatschappij N. V., the Hague. The previous name LOCUS has been changed to LINCO for foreign language reasons. The system is based on the use of Chemical structural formulas, which are treated as networks containing branching points, giving to these points and arbitrary number and writing down the series of atoms between two points of that type together with series of atoms extending from such branching points but not meeting others. The LINCO notations can be easily typed on conventional tape-making typewriter and used as the input system. The notations make it possible to search for whole compounds by simple comparison.

[Bouman, H: Computer program for the LINCO system. J chem Doc 1965, 5(1), 14-24]

LITE (Legal Information Thru Electronics): A system established in 1964 at the U. S. Air Force Accounting & Finance Center, Denver, to store and supply legal and regulatory information to departmental users interested in legal, fiscal and financial management. It uses IBM 1410 computer with 1403 printer and 1402 card reader-punch.

[Nonconventional scientific and technical information systems in current use, No. 4, p. 432]

MAC (Machine Aided Cognition, 'Man And Computer') and a few detractors allege stands for MIT at Cambridge. This is a model project operating in a realistic test environment at the MIT. In its present configuration, a user may sit at an electric typewriter, scan a stated range of literature and perform a search based on keywords, keyword in context, citation index, bibliographic coupling, author, location, and various combinations of these. The response is printed back on the same typewriter within seconds of the request. There is no intermediaries between the user and the system, and the system uses a language very close to natural English.

[Kessler, M.M.: The MIT Technical Information Project, Phys today 1965, 18(3), 28-36]

MARLIS (Multi-Aspect Relevance Linkage Information System): Developed at Imperial Chemical Industries Ltd., Research Department, Hertfordshire, England. It basically comprises three distinct units with some ancillary equipment. The first unit, the Intermediate Store, consists of a store of records, on each of which is inscribed: (a) one or more addresses in the ultimate store; and (b) code symbols characterising the items at these addresses. These code symbols relate to only a few selected aspects (Characterising features) of the items in the ultimate store. For each set of symbols (descriptors authors, etc.) records are arranged in the ordinal sequence of that set. The records may be physically separate units, slacked serially in cabinets, or they may be grouped in sheets. Other forms of storage may also be used: photographic, magnetic, etc. The second unit of the MARLIS is the ultimate store. This may also take several physical forms, but it consists essentially of an assembly of items which is known as "volumes" because of the large amount of information each contains. On each of these volumes is inscribed a symbol which is its address, and by which it is identified in the Intermediate Store. The third unit of the MARLIS is known as the HOMO, so called because it is almost human, is the computing unit of the system. It includes input and output devices, and a memory, comparison and control organ.

[Vickery, B.C. (The) MARLIS: A Mulli-Aspect Relevance Linkage Information System - Present position and future needs. Amer Doc 1960, 11(2), 97-99]

MATICO (Machine Application to Technical Information Center Operations). A system established in 1962 at the Lockheed Missiles and Space Co., for generation of catalogue cards, KWIC announcement bulletin and retrieval history tape. It adds about 85,000 documents per year of all types on all aerospace related fields like missiles, ocean systems, astronomy, chemistry, physics etc. Indexing terms are used from the Library of Congress List of Subject Headings and Thesaurus of ASTIA Descriptors. Indexing characteristics used are subject terms or descriptors, personal author, organizational or corporate author, project name or number, report number, contact number, security classification, geographic location of originating organization, date of issuance and publisher. Equipment used are IBM 1401, 1410 and 7094 computers.

[Conconventional scientific and technical information systems in current use, No. 4, p. 205]

MEDIA (Magnavox Electronic Data Image Apparatus): The system was first demonstrated by Magnavox in 1961. This photographic unit-record storage system uses a combination of manual and machines search techniques. The basic film chip is a 16 mm-by-32 mm card that contains upto two 9-by-15 inch page images at a reduction of 30:1, and an information field of up to 17 encoded and human-readable digits to identify the image. The documents are photographed on 100 foot rolls of microfilm using a special camera unit, processed, and cut into cards of the rate of 240 per minute. The cards are kept in capsules or cartridges containing upto 200 cards. These capsules are stored in regular file cabinets and are handled and selected manually. To retrieve a specific file item a clerk selects capsule number from the file cabinet mounts it in the selector unit, and keys in the last two digit. The cards are then scanned at the rate of 600 cards per minute to select the desired one. This unit can provide a page-size blowback of the card image if desired. A browsing unit is also available; with this, the user can view the cards in a capsule one at a time in a regular microfilm viewer-printer, and can transfer selected copies to hard copy form.

[Jenkins, D.D. "Magnetic Indexing, Microfilm Storage and Information Retrieval" in Proc of the 11th Annual Convention of the National Microfilm Association, pp. 205-12. (National Microfilm Association, Annapolis, Maryland, 1962).
Laurent, R.L. "Magnacard-Magnavue-MEDIA", paper presented at a special conference of the Los Angeles Chapter of the American Documentation Institute (Los Angeles, September 1961)]

MEDLARS (Medical Literature Analysis and Retrieval System): The project is in operation at the National Library of Medicine (NLM) since 1964. It is a multi-purpose system designed, (1) to manipulate citations for the composition of published indexes, including the monthly Index Medicus and its annual cumulation, (2) to re-package citations in the store to create specialized recurring bibliographies (or group Selective Dissemination of Information Services), and (3) to perform mechanised retrospective searches on specific medical topics and prepare demand bibliographies. It is a publication system as well as a retrieval system.

In order to meet the speed and volume requirements of the system, the following items of data processing equipment are employed: punched-paper-tape typewriters for conversion of source data to machine readable form; a Minneapolis-Honeywell 800 computer for editing, sorting, compressing, merging, and formating data for subsequent printing; an optical printer called GRACE (Graphic Arts Composing Equipment) for converting computer output into high-quality photo-copy; and an automatic film processor for developing the film from GRACE, thus producing a photomaster for printing plates.

The NLM plans to decentralise the MEDLARS search capabilities by distributing magnetic tapes to university and other medical research centres with adequate library and computer facilities. Two pilot centres have already been established under this plan, one at the University of California and the other at the University of Colorado Medical Center (UCMC).

[The MEDLARS story at the National Library of Medicine Washington, Dept. of Health, Education and Welfare 1963, p. 74.
Adams, Scott: MEDLARS, progress and prospects. (In Toward a national information system — 2nd annual National Colloquium on Information Retrieval. Washington, Spartan, 1965, p. 77-85).
Austin, C. J.: The MEDLARS Project at the National Library of Medicine. Lib Res tech Serv 1965, 9(1), 94-99]

MELISS (Literature and Information Search Service) MELCOM-1101 computer: A mechanized retrieval system under development at the Mitsubishi Electric Corporation, Japan. MELISS will be able to produce lists of accession numbers, technical information cards (abstract cards) or copies of original papers. The system will use coordinate indexing and use English language descriptors instead of codes. The user types the request in the same language as that used in the tape memory and the request is then fed into the computer. In the preliminary stages, average retrieval time was less than 48 seconds per 300 documents.

[Current Research and Development in Scientific Documentation. No. 13, NSF-64-17, p.132]

MERGE (Mechanized Retrieval for Greater Efficiency): The system has been recently developed by IBM to provide the Space Guidance Center with complete information retrieval and dissemination capability based on IBM 7090 and IBM 1401 computers. The system uses a controlled vocabulary in the form of the Thesaurus of Armed Services Technical Information Agency (ASTIA) Descriptors. The output of the system includes, SDI notification-response/abstract cards; a standard KWIC index (weekly bulletin of accessions), literature searches based on Thesaurus selective KWIC indexes based on documents selected during an SDI run; specialised KWIC index based on preselected keywords, descriptors, corporate authors, personal authors, contact numbers, and statistics for acquisition direction and weeding of the collection. It is essentially a system linking the techniques of KWIC with SDI.

[CRDSD, No. 13, p. 248; No. 14, p. 317]

MIRACODE (Microfilm Retrieval Access CODE): This is the name given to a 16 mm. film based system designed and developed by the Eastman Kodak Company. Miracode stores graphic images together with digital retrieval code. The Recordak Lodestar Reader-Printer has been modified by the addition of photocells, keyboards, and logical circuitry to permit automatic location (and printing) of document images based on logical comparison between keyboard criteria and binary coded data fields recorded on the film. The search equipment may also be actuated manually for 'browsing', where a visual image is presented on a screen or may be set to produce prints of automatically selected documents.

[CRDSD, No. 13, p. 244]

PACIR (Practical Approach to Chemical Information Retrieval): The object of the PACIR System is to provide a flexible univeral approach to specific compound retrieval that is not limited to the unique characteristics of a particular area of chemistry, that is adaptable to various types of hardware, that employs a maximum of machine assistance in the analysis, that provides a file that may be organized according to the need of the user, and that is practical from the economic viewpoint. This system has been developed at the Office of Research and Development of the U.S. Patent Office through several years' experimentation. The PACIR approach has the following characteristics: (1) non-art limited; (2) capable of storing and retrieving compounds, processes, compositions, biological data, etc.; (3) both specific and generic potential; (4) compatibility with several machines, including both random access and serial computers; (5) segmentable in accordance with need; (6) unlimited dictionary (open ended); (7) machine assisted encoding; (8) economic practicality.

The PACIR approach incorporates two different types of analysis that allow for selective depth of coding for a given type of subject matter in the chemical art being analyzed. One of these approaches is an underlining and role-assigning technique that produces catalogs of the ancillary subject matter of the art. The other procedure provides for specific coding in depth of any selected type of compound that can be represented by the conventional chemical structural formula. Both of these procedures are universal in scope as they are not limited by the need for a unique nucleus. In the application of PACIR to any particular chemical art, the analysis procedures are allocated to the various types of chemical subject matter within the art depending on consideration of cost and search need.

This system attempts to provide a standard analysis and linear and semi-automatic encoding technique that allows flexible and varied use of the analyzed subject matter. The approach has eliminated the dependence of the analysis on a particular type of file organisation, coding, or machine.

[Frome, J., O'Day, P. T. PACIR: Practical Approach to Chemical Information Retrieval. J chem Doc 1962, 2(4), 248-55]

PHILSOM (Periodical Holdings in the Library of the School of Medicine): Strictly speaking this is a product of a mechanized system. It symbolises the successful application of mechanized techniques in the routine works in the serials division of a library, like accurate determination of receipt of journals, correct billing and accounting, record keeping for binding, compilation of statistical reports, and preparation of disseminable lists of library serials holdings etc. At the Washington University School of Medicine Library all these have been computerised, so that checking of receipt of issues, updating of holdings record and claims for issues not received are done automatically. The system, also produces two semi-annual lists: 1) PHILSOM, which contains all titles, holdings, history of variant titles etc; 2) PHILSOMS arranges all the currently received titles into appropriate subject classifications.

[CRDSD, No. 13, p. 183,
Pizer I H, Franz D R, Brodman E: Mechanization of library procedures in the medium sized medical library 1. the serial record. Bull med Lib Ass 1963, 51(3), 313-38]

PICS (Pharmaceutical Information Control System): Developed at the Merck Sharp & Dohme Research Laboratories, and in operation since April 1963, provides centralized control and methodology for the series of decentralized information areas. The system input is approximately 1,000 documents per day, composed of reports, memoranda, correspondence, laboratory notebooks, regulatory agency submissions, prepublication manuscripts, etc. Published information is excluded from this system. An eight-digit, dual-faceted classification scheme has been designed for Division-wide project and product identification. Search requests are normally initiated through a telephone call or a personal visit from the user to the center.

[Kolb, Margaret C, Jerome T. Maddock, and Barbara N. Weaver: PICS – The Pharmaceutical Information Control System of Merck Sharp and Dohme Research Laboratories. Amer Doc 1966, 17(4), 180-85]

RAPID (Retrieval through Automated Publication and Information Digest): This name is given to the conceptual model of a coordinated, semiautomated information system that can improve dissemination without increasing storage problems. The whole system is built around a special science newspaper. Responsive to the recommendations of the Weinberg Report the RAPID system makes it obligatory on all authors to help others use that information, by selecting appropriate indexing terms, and in other ways. RAPID system has dual operation mission: (1) to publish and disseminate information; and (2) to process information in order to respond to specific requests.

[Schultz, Louise: RAPID, a system for retrieval through automated publication and information digest. Proc Amer Doc Inst Vol 1. Parameters of information science, annual meeting, Philadelphia 1964, pp. 79-87]

SABIRS (Semi-Automatic Bibliographic Information Retrieval System): The system is being successfully experimented at the U.S. Naval Postgraduate School. Descriptors and uniterms are used in the storage and searches of documents. The Control Data Corporation 1604 computer is used for the search and retrieval process and the IBM 1401 computer is utilized for printing search and file updating data.

[CRDSD, No. 13, p. 168]

SAID (Automated Information Disseminator): The Datatrol Corporation has developed this system which is designed for the IBM 1401 computer. It uses similar contexting and weighting techniques, like the ALP system, in the selective dissemination of information.

[Current Research and Development in Scientific Documentation: No. 13, NSF-64-17, p. 83]

SATIRE (Semi-Automatic Technical Information Retrieval): The system has been operating in the System Development Corporation in California using electronic accounting machine equipment. From one typing (keypunching) operation five records (library cross-reference card catalogues, automatic charge-out cards, selected bibliographies, library indexes for publication, association lists) are produced. It can retrieve according to accession and report numbers, author, title, and subject. Subsequently, increased retrieval capabilities were obtained by moving to a computer-based system, and incorporating equipment to allow for 'self-service' and the provision of hard copy of retrieval information as final output.

[Roach, John P: SATIRE, the technical librarian's EAM application of Semi-Automatic Technical Information Retrieval. Santa Monica, California, System Development Corporation, 1961, p. 14 (SP-595)]

SCAN (Short Current Abstracts and Notes): A literature abstracting, publication and retrieval system in operation at the Wyeth Laboratories. The objective is to produce a means for acquainting both non-scientific and scientific personnel with current information from the literature and also to find information on demand. The heart of the system is the IBM 870 Document-Writing System. The organization is made up of a master input system producing three subsystems-publication, machine language and search. Each document is abstracted and indexed by editors and then using the IBM 870 punched cards and a set of 5 x 3 cards are generated which include the abstract text and citation. From the 5 x 3 cards, with the help of the Kodak Ektalith Processor and Camera, a weekly current awareness list is produced. The punched cards are filed in the search subsystem. The output format may be title only, title and author or full citation.

[Elias, A W: SCAN - a flexible scientific literature system. Proc Amer Doc Inst Vol I. Parameters of information science, Annual meeting, Philadelphia 1964, pp. 121-29]

SCISRS (Sigma Center Information Storage and Retrieval System): A system established in 1964 at the Brookhaven National Laboratory under support from the U.S. Atomic Energy Commission. Its purpose is to store and supply experimental neutron cross section data to users culled from all types of documents like books, articles in periodicals, meeting proceedings, review publications, abstracts from internal or external abstracting publications or services, correspondence, theses, etc. Indexing characteristics used are, subject or concept terms, headings or descriptors, personal author, organizational or corporate author, report number, type or form of document and date of issuance of publication. The index term relationship is established by chemical element.

[Nonconventional scientific and technical information systems in current use, No. 4, p. 267]

SHARP (Ships Analysis and Retrieval Project): The objective of the project is to develop a computer-oriented information storage and retrieval system for the Bureau of Ships Technical Library (U.S.). A thesaurus of descriptors using links and roles has been developed and tested. The project will also computerise some of the library procedures and works.

[Current Research and Development in Scientific Documentation No. 13, 14, NSF-66-17, p. 69, 303]

SHIRTDIF (Storage Handling and Retrieval of Technical Data in Image Format): The speciality of the system is that it uses two storage media – digital storage for descriptive information and analog storage for copies of documents, and uses computer based search methods. This separation of descriptive information from document image is advantageous because any updating (e.g. adding new descriptions) is possible without necessitating the retaking of picture or in any other way disturbing the position and sequence of the document image. Imagesare stored on high-density film by photochromic process. This permits linear reductions of up to 200:1, corresponding to a 40,000:1 area reduction with high resolution, so that images can be stored in a very small amount of space. One 3 x 5 card can contain 2600 images. When a card is put into the system it is assigned a key which when typed on the keyboard the edge of the card is notched. To retrieve the card, the user types the key on the keyboard and a series of rods is set which finds the property notched card. Any page from a selected card can be viewed on a display screen through a viewer and a hard copy print obtained within 30 seconds, with multiple copies if desired.

[Dam, Andries van and Evans, David: SHIRTDIF – a system for the storage, handling and retrieval of technical data in image format]

SIDAR (Selective Information Dissemination and Retrieval): The system has been developed at Chemicals and Phosphates Ltd., Haifa, Israel. It is a modification of the SDI (Selective Dissemination of Information) first proposed by H.P. Luhn and implemented by A.J. Sowarby for the IBM 1401 DPS. The dissemination procedure is effected in two runs, SELECT and NOTIFY.

[Ofer, K.D. SIDAR: Selective Information Dissemination and Retrieval. J chem Doc 1964, 4(1), 54-55]

SMART (Socony Mobil Automatic Real Time): Computer System: The system is in operation since 1962. This computer-communications system has enabled Socony personnel at remote locations to transmit data to the computer centre at New York, direct the computer to perform certain computational and/ and/or retrieval functions, and to receive 'answers' an a matter of seconds. Thus as many as 64 different company locations may use the large scale computing capabilities of the headquarters. Computer facilities, at present, are IBM 1410-80K computer, IBM 1301 random access disk memory, and a Digitronics buffer and they are linked with conventional teletype machines.

[Wilson, H.B.: SMART (Socony Mobil Automatic Real Time) Computer System. J chem Doc 1966, 6(2), 89-92]

SMART (Salton's Magical Automatic Retriever of Texts): The system has been developed by Gerard Salton of the Computation Laboratory of the Harvard University. SMART operates on the IBM 7094. 'Unlike other automatic systems which rely on manually assigned keywords or index terms for the identification of documents and search requests, an attempt is made in the SMART system to go beyond simple word-matching procedures by using a variety of intellectual aids in the form of synonym dictionaries and thesauri hierarchical arrangements of subject identifiers, statistical and syntactic phrase-generating methods and the like, in order to obtain the content indentifications useful for the retrieval process.

[Salton, Gerard: The evaluation of automatic retrieval procedures-selected test results using the SMART system. Amer Doc 1965, 16(3), 209-22.
Current Research and Development in Scientific Documentation, No. 14, p. 314]

SWIFT-LASS (Signal Word Index of Field and Title-Literature Abstract Specialized Search): A system established in 1966 at the Carborandum Co., N.Y., for listing and retrieval of abstracts of literature in the subject fields of applied statistics, precision analysis of tests, quality control, bulk material sampling and inter-lab testing. The medium of document storage is keysort cards. Indexing characteristics used are subject terms or descriptors, personal author, date of issuance of publication, and accession number. Descriptors used are words in title. Main equipment used are IBM 7090, 360 computers IBM reproducer, IBM interpreter, and UNIVAC SS II computer.

[Nonconventional scientific and technical information systems in current use, No. 4, p. 269]

SWIFT-SIR (Signal Word Index of Field and Title-Scientific Information Retrieval): A system established in 1965 at the Carborandum

Co., N.Y., for storage and retrieval of letter reports, memoranda, and final reports of the mathematics branch covering the fields of applied mathematics and statistics, quality control, operations research and scientific computing. Media of index storage are standard punched cards, magnetic tape, and book or other page arrangement. Indexing characteristics used are subject terms or descriptors (which are words in title), date of issuance of publication, accession number, sequence number. Main equipment used are IBM 7090, 360, IBM reproducer, IBM interpreter, and UNIVAC SS II computer.

[Conconventional scientific and technical information systems in current use, No. 4, p. 272]

TERMATREX and MINIMATREX system: The two concepts have been developed and a line of equipment using the concepts have been produced by the Jonker Business Machines Inc. Termatrex systems are basically information-retrieval or 'search' systems, which works on the simple principle of super-imposition of characteristic cards over a light source (peek-a-boo system). Each 'item of information' is naturally identified by a serial number and on the Termatrex card it is represented by a hole which can be correctly interpreted by its position in relation to the X and Y coordinates. The basic limitation of the Termatrex system is that the capacity of a set of characteristic cards is limited to 10,000 items of information. For each additional 10,000 items of information, a complete additional set of cards is needed. However, when a collection becomes too large, the user can switch over to "Minimatrex line". This is done by photographic miniaturization which reduces Termatrex cards to an area 1/2" x 1/2" on strips of film.

[Jonker, Frederick: The new Termatrex line of I. R. systems - The Minimatrex line of I.R. systems. Amer Doc 1963, 14(4), 276-82]

TABLEDEX index: A coordinate index displayed in tabular form. Basically it consists of three parts – the first is a retrieval-word list of index terms used, the second is the TABLEDEX tables, or index proper, the third is the bibliography proper. The National Biomedical Research Foundation, Maryland has prepared computer programs to compile TABLEDEX index. A good example of TABLEDEX format is the 'Selected Bibliography of the International Geophysical Year' published by the National Biomedical Research Foundation, 1962.

[CRDSD, No. 14, p. 135]

UNIDEX: A name given to a mechanized application of the UDC for index preparation. The system has been developed by the American Meteorological Society to speed up and improve indexing operations for their Meteorological and Geoastrophysical Abstracts and the experimental Meteorological and Geoastrophysical Titles.

[CRDSD, No. 13, p. 203.
Rigby, Malcolm: Experiments in mechanized control of meteorological and geoastrophysical literature and the UDC schedules in these fields. Rev int Doc 1964, 31(3), 103-106]

WALNUT: WALNUT is a code name for a complex, mechanized, micro-image storage and retrieval system (IBM 9603 Image File) developed for a federal agency by the IBM Corporation. This system consists primarily of a file of microfilm strips stored in bits and a mechanical selection device that can quickly go to a specified bit, mechanically select a strip of microfilm, and copy images from that strip into aperture cards. The basic image file unit contains a total of 990,000 page-size images (200 plastic cells of 50 strips each, with 99 images on each strip) stored at a 35:1 reduction. This is equivalent to about 3000 books or the contents of about 100 filing cabinets. Given an image number and page count, random-access selection equipment can locate the desired image in less than 5 seconds and transfer it to a blank frame of Kalfax film mounted in aperture card.

Another piece of equipment which accompanies the basic file unit is the IBM 9403 Image converter (This unit serves as the file input device by transferring images from conventional 35 mm sprocketed silver microfilm (at an original reduction of 15.8:1) to the kalfax file strips at a further reduction of 2.2:1. The file strips utilize kalfax film that has an image resolution on the order of 500 to 600 lines per mm. The Image converter operates at a maximum rate of 1500 frames per hour to transfer images to the file strips, assign addresses, and punch these addresses into a tab card.

A few of these WALNUT units have been developed, but to date only the Central Intelligence Agency is using them.

[Bradshaw, P.D. "The WALNUT system: A large capacity document storage and retrieval system. American Documentation 1962, 13(8), 270-5.

Veyette, J.H., Jr. "Photo-image storage: Its role in modern business" (includes a description of the IBM WALNUT system). Business Automation 1961, 6(4), 16-21]

List of Terms Explained in the Glossary

ABC
ABCD
ABLE
ACORN
ALP
ALPHA
ASCA

BRALD

ChemSEARCH
CITIS
COMEINDORS
COMIT
CRIS

DACOM

FAIR
FLIP

GREMAS

HAYSTAQ

IDEEA
INTREX

KAPL
KWIC

LINCO
LOCUS [under LINCO]
LITE

MAC
MARLIS
MATICO
MEDIA
MEDLARS
MELISS
MERGE
MINIMATREX [under TERMATREX]

PACIR
PHILSOM
PICS

RAPID

SABIRS
SAID
SATIRE
SCAN
SCISRS
SHARP
SHIRTDIF
SIDAR
SMART
SWIFT-LASS
SWIFT-SIR

TABLEDEX
TERMATREX

UNIDEX

WALNUT

COMPUTERISED DATA RETRIEVAL: AN EXPERIMENT WITH IBM 1620*

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The objective of this experiment was to find out the suitability in the storage and retrieval of data using the IBM 1620 computer facilities and the Fortran IID language. The IAEA's Directory of Nuclear Reactors, vol 1 — Power Reactors, was used as the data source for the experiment. The method followed in encoding and programming are described. The results of programmes for search and listing are presented.

INTRODUCTION

The experimental cell of the Projects Division, having gained familiarity with problems like computer processing of the Union Catalogue data and preparation of indexes by computer, devoted some thought to problems in data retrieval with the facilities available to the cell. The opportunity was provided when one of the authors was deputed for the IInd Training Course in Documentation and Reprography, at Insdoc during the year 1965-66. As part of this Training Course a data retrieval project was assigned and had to be completed during the period of the course. The present article reports the work done during this period.

This experiment on data retrieval is based upon the data available in the IAEA Directory of Nuclear Reactors Vol. I, Power Reactors, referred to here as Data Source. The accent in this experiment has not been on the collection of data from primary sources. Rather, the attempt has been one of using this as source for experiment with the objectives delineated below:

1. Familiarization with the IBM 1620 computer system;
2. Gaining experience in storing data on disk;
3. Retrieving data through the computer; and
4. Producing intelligible lists of data.

The Data Source

The purpose of the data source is to make available important details of the various power reactor projects. Information is presented in such a way as to provide easy reference to technical staff and management in the field of atomic physics. Information is presented in an uniform way for each reactor. The information for each reactor is presented under major heads such as 'general information', 'reactor physics', 'core data' etc. Each of these major heads is broken down further into subheads (e.g. under the major head core we find subheads-shape and dimensions. No. of channels and subassemblies, lattice, critical mass etc.) The qualitative and quantitative information pertains to specific heads under each of these subheads (e.g. under the subhead dimensions, data on length (specific head), breadth etc. may be provided). No attempt in this experiment, has been made to add, verify, modify or supplement the data already available in the data source.

Method

The work in this experiment may be broadly divided into: (1) Encoding; and (2) Programming. In this part are considered method and details in encoding and programming.

Encoding

The word 'encoding' as used here includes all the operations necessary to record the data source onto punched cards. The operations involved in order of the flow of work were:

1. Decision as to items to be recorded;
2. Field allocation for punched cards;
3. Transcription of data onto code sheets; and
4. Key punching of data onto cards, and verification.

Based on a Project Report submitted to INSDOC, as a part of its Training Course in Documentation and Reprography during 1965–66.

Decision as to items to be recorded

An item of data is characterized by three variables: the kind of measurement (length, breadth, gross electricity etc.), the numerical value of the measurement, and the units of measurement. It was necessary to decide whether to record all, some or any combination of these variables. It was decided that only the numerical value of a measurement and the units of measurement would be recorded. At the time of search and listing the kind of measurement searched or listed would be taken care of by programming. It was also decided not to include items that where narrative in nature.

Specific heads

Another decision taken was to present the data under the same major heads and subheads as found in the data source (See item 6 in the Appendix). The specific heads under each subhead posed a problem. In order to maintain uniformity, it was necessary to have the same specific heads for each reactor under each subhead. This involved the scanning of the directory under each subhead to call out the relevant specific heads occuring under each subhead. This has the disadvantage of providing certain specific heads which were not relevant to an item of data. (e.g. the dimensions of a cylinder can be fully represented by the height, and diameter. Here length and breadth would be superflous). The provision of uniform specific heads for each reactor, however, has two advantages: (1) ease in allocation of fields on punched cards; (2) provision of space on punched cards for data that is not available now, but may become available subsequently.

An example of the specific heads provided by this experiment under the major head 'core' is presented below. Words occuring at the first indention are the subheads and those at the second indention are the specific heads.

MAJOR HEAD: CORE

SHAPE

DIMENSIONS
  DIAMETER/BREADTH
  HEIGHT
  LENGTH

NO. OF CHANNELS
  FUEL
  CONTROL ROD
  FUEL ELEMENT
  SAFETY ROD

NO. OF SUBASSEMBLIES
  FUEL ROD
  STATIONARY
  MOVEABLE

LATTICE
  SHAPE
  PITCH
    FUEL RODS
    SUBASSEMBLIES
SPACING

CRITICAL MASS

CORE LOADING AT RATED POWER

AVG. SPECIFIC POWER IN FUEL

AVG. POWER DENSITY IN CORE
  SEED
  BLANKET

BURN UP
  AVG.
  MAV.
  PERCENTAGE

REFUELLING SCHEDULE
  PARTIAL
  FULL
DOWN TIME

MODERATOR
WEIGHT/QUANTITY
  IN CORE
AVG. TEMP
MAX. TEMP

Such decisions were taken for all the major heads.

Allocation of fields

Field allocation in the experiment was based on empirical considerations and proceeded along the following lines:

1. The data source was scanned at random under each subhead and specific head to find out the maximum number of columns required for data under any specific head of information. For instance, if say, the length (numerical value plus units of measurement) of an item did not exceed 6 characters, 8 to 10 columns were provided on the card. This was with a view to accommodate exceptional cases that might occur.
2. The field length, thus selected was put to test and any changes in the field length necessary was made.

3. The number of cards required to record the data for each reactor under any major head of information was more than one in all cases. It was, therefore, necessary to allocate one field on each card for the purposes of identification and arrangement, in case a deck of data cards got disarranged. The field chosen for this purpose was columns 74 to 80. The columns 74 and 75 were devoted to the card number. Columns 76, 77, 78 were devoted to the reactor serial number. Columns 79 and 80 were devoted to the major head (General Information, Core etc.). Thus for instance, if the punching in these columns was 0100103 it meant the first card or 01 card, of reactor with serial number 001, of the major head 'core' (core being given the code 03). With the help of this field, it was possible to maintain all cards pertaining to data under any major head of any reactor in strict order. This is important since any innaccuracy in the order in which data is fed into the computer will result in innaccurate lists as well as wrong search results.

Given in the next page is an example of the field allocation done for the specific heads of data under the major head 'core'.

Transcription of data to code sheets

The recording of data on code sheets was done in strict accordance with the field allocation. Thus for instance if on card 01 of the major head core columns 1-26 were allocated for core shape, the shape (e.g. cylinder, polygonal prism) was recorded, as such in these columns. The next item of data was recorded from column 29 onwards and 50 on. An example of data recorded on a code sheet is presented in appendix 15).

Conversion

The data on code sheets were now punched and verified using the IBM 024 and 056 punch and verifier respectively. The card file was now ready for further processing on the computer.

Programming

The programming done in this experiment may be considered under three heads:

1. Programmes for the storage of data;
2. Programmes for the retrieval of data as answers to queries; and
3. Programmes for the listing of data in an intelligible form.

Programming for the Storage of data:

The storage of large masses of data constitutes one of the basic operations in a data retrieval system. The basic operation in this experiment was to store data on disks, to facilitate further manipulation either for retrieval or for listing.

The data that was encoded on punched cards, had to be first read into the internal memory before being transferred to disk. The method of loading the data into the memory was as follows:

Items of data under specific heads of a major head were made elements of a matrix. Each column in this matrix represented the data under a major head for one reactor. Thus for instance, core data for all the reactors would internally be represented as the matrix below (The figures in the parentheses indicate the row and column number).

$$\begin{array}{lll}
\text{CORE}(1,1) & \text{CORE}(1,2)\ldots\ldots & \text{CORE}(1,n)\\
\text{CORE}(2,1) & \text{CORE}(2,2)\ldots\ldots & \text{CORE}(2,n)\\
\text{CORE}(3,1) & \text{CORE}(3,2)\ldots\ldots & \text{CORE}(3,n)\\
\vdots & \vdots & \vdots\\
\text{CORE}(m,1) & \text{CORE}(m,2)\ldots\ldots & \text{CORE}(m,n)
\end{array}$$

'Core' is the name given to the matrix by which data on the reactor core would be referred to internally in the computer. The quantity 'm' represents the number of elements in core data and 'n' represents the number of reactors. The value of m was different for different major heads, while n remained constant. The values m, n together constitute the dimension of a matrix.

Each element or a consecutive group of elements of a column of this matrix represents data under any specific head. For instance elements CORE(1, 1); CORE (2, 1); and CORE (3, 1) together would internally represent the data under the specific head 'shape of core' for the reactor number 1. Generalizing CORE (1,n); CORE (2,n); and CORE (3,n) together would internally represent the core shape of reactor number 'n'.

MAJOR HEAD: CORE (CODE : 03 in Cols 79 and 80)

SUBHEAD	SPECIFIC HEAD	CARD COLS.	CARD NO. (CODE IN COLS. 74-75)	LENGTH OF FIELD
SHAPE		1-28	01	28
DIMENSIONS	DIAMETER/BREADTH	29-36	01	8
	HEIGHT	37-44	01	8
	LENGTH	45-52	01	8
NO. OF CHANNELS		53-58	01	6
	FUEL	59-64	01	6
	CONTROL ROD	65-70	01	6
	FUEL ELEMENT	1-6	02	6
	SAFETY ROD	7-12	02	6
NO. OF SUBASSEMBLIES		13-18	02	6
	FUEL ROD	19-24	02	6
	STATIONARY	25-30	02	6
	MOVEABLE	31-36	02	6
LATTICE				
	SHAPE	37-54	02	18
	PITCH	55-62	02	8
	FUEL RODS	63-70	02	8
	SUBASSEMBLIES	1-8	03	8
	SPACING	9-14	03	6
CRITICAL MASS		15-28	03	14
	AT (TEMPERATURE)	29-37	03	9
CORE LOADING AT RATED POWER		38-65	03	28
AVG. SPECIFIC POWER IN FUEL		1-28	04	28
AVG. POWER DENSITY IN CORE		29-42	04	14
	SEED	43-54	04	12
	BLANKET	55-66	04	12
BURN UP				
	AVG.	1-14	05	14
	MAX.	15-28	05	14
	PERCENTAGE	29-30	05	2
REFUELLING SCHEDULE				
	PARTIAL	31-33	05	3
	FULL	34-36	05	3
	TIME INTERVAL	37-48	05	12
	DOWN TIME	49-60	05	12
MODERATOR		1-24	06	24
	WEIGHT/QUANTITY	25-34	06	10
	IN CORE	35-44	06	10
	AVG. TEMP	45-54	06	10
	MAX. TEMP	55-64	06	10
BLANKET GAS		1-14	07	14

Thus search for the shape of a reactor core would mean searching the first three elements of each column in the matrix for data on reactor core. Since the correspondence between an element or elements of the matrix and a specific head is known before hand search and listing are greatly facilitated. Further, it is possible to build up this correspondence between specific heads and the elements of the matrix as a machine dictionary. At the time of search it is possible to program the computer to ascertain first the major head under which the item of data occurs and then also the element(s) that constitute the data itself. Once these are ascertained specific searches can be made.

The data pertaining to each major head (for all reactors) was read into the memory as a matrix. The matrix representing data pertaining to each major head was given a mnemonic name, such as GENER for 'General Information', CORE for 'Core data' and so on.

Transfer to Disk.

Once the data was read into memory, transfer to disk was accomplished as follows:

A specific sector of the disk was made ready to be written upon. (A sector of the disk is a unit portion of the disk on which can be stored 100 digits or 50 alphameric characters). The writing of data began from this sector and was continued in sectors having addresses in an ascending sequence, until all the data was stored. With the knowledge of the address of the first sector and the number of elements of a matrix that were stored in any one sector, it was possible to cull out from the disk and put into memory any specific portion or portions of the data pertaining to any major head either for search or for listing.

The block diagram given in Fig. 1 represents broadly the method followed in storing data on disks.

Retrieval Programmes

The actual manipulation of a file for retrieval is preceeded by an analysis of the question and decision as to the search strategy to be adopted. In a computer system, the strategy is generally translation into a programme. Once a generalized programme for a type of search strategy is made it can be used, with minor alterations, for other searches of a similar nature.

In this experiment a user's profile has been assumed. Attempt has been made to include search programmes based on a few search strategies.

The search strategies for which programmes were written are:

1. Single aspect search;
2. Logical product search;
3. Between the limits search; and
4. Search for upper limit of an item of data.

Single Aspect Search

The question chosen to write a programme for this kind of search was: What are the names of reactors whose core shape is a cylinder?

In order to retrieve names of reactors with core shape equal to a cylinder, it was necessary to define a variable(which was named 'Quest') and make it value equal to 'Cylinder'. The portion of the core data for each reactor which contained information on its shape was fetched from the disk. The shape of each was compared with the value of Quest. Whenever there was an equivalence, a branch was made and name of the reactor was printed out. This proceeded until the core shape of all reactors in the file were searched.

The block diagram for this type of search is given in Fig. 2. The results of this programme are presented in appendix 1.

The programme written for the single aspect search could be used for similar searches with alterations in the definition of the variable 'Quest' and in comparison statements depending upon the number of elements in the matrix to be compared with the value of Quest.

The Logical Product Search

The question chosen for writing and testing a programme for this type of search was: What are the names of the Reactors, which are Pressurized Light Water Cooled and in operation in the U.S.A. ?

In order to retrieve names of reactors satisfying both the criteria given above the search had to first proceed as follows:

Two variables had to be defined say Q 1 and Q 2. The variable Q 1 was given the value 'Pressurized Light Water' and Q 2, was given the value 'U.S.A.' These variables were then read into memory. The General Information pertaining to each reactor was fetched (since coolant and country are to be found under the head General Information) from the disk into memory. The elements constituting the coolant of a reactor was compared with the variable Q 1; on equivalence, the elements of the matrix constituting the country in which the reactor was located was compared with Q 2. Again on equivalence, a branch was made and the name of the reactor was printed out. Thus only when both conditions were satisfied the name was printed out.

The block diagram for this search is given in Fig. 3. A portion of the programme written in Fortran-II is given in appendix 2. The results of this search are presented in appendix 3.

The programme written for the logical product search could be used for similar searches with alterations in the definition of the variables Q 1 and Q 2, and in comparison statements depending upon the number of elements in the matrix to be compared with values of Q 1 and Q 2.

Between the Limits Search Programme

The question chosen for writing and testing a programme for this type of search was: What are the names of the reactors whose net efficiency falls in the range of 20 and 30 per cent?

That is $20\% \leq$ net efficiency $\leq 30\%$.

In order to retrieve names of reactors satisfying the above condition, the method adopted was as follows:

The two limits, viz: 20 and 30 were made equal to two variables LIMI and LIMZ. These variables were read into the memory. The General Information pertaining to each reactor was fetched from the disk since net efficiency is a specific head under General Information. The net efficiency of each reactor was first compared with the lower limits. If it was found to be greater, or equal a branch was made and the net efficiency was compared with the upper limit. If it was lesser or equal, a branch was made and the names were printed out as search results. If either one of these was not satisfied, the search proceeded to the net efficiency of the next reactor and so on until the entire file was searched.

The block diagram for this type of search is given in Fig. 4. The results of the search are presented in the appendix 4.

Search Programme for Upper Limit of an Item of Data

The question chosen for writing and testing a programme for this type of search was:

What is the name of the reactor in your file with the maximum rated output. Also give details pertaining to its core and fuel element?

The method followed was as follows:

The General Information for all reactors was fetched into memory. The element(s) constituting the rated output of the first reactor was compared with that of the second reactor. The greater of the two was made equal to a variable which was named EMAX. EMAX was compared with the rated output of the next reactor. The greater of the two replaced the former EMAX. This continued until all the reactors in the file were searched. The value of the final EMAX gave the highest rated output of any reactor in the file. The name, core and fuel element information pertaining to this was then printed out.

The results are given in appendix 5.

Programmes for the Listing of Data

As a by product, a data retrieval system using computers could produce frequent compilations of data. It was with this view that programmes for the listing of data was attempted. Any attempt at listing of stored data has its implications at every stage of work. For instance, it is necessary at the time of encoding to record the data as it is found in the source. In other words codes for items of data cannot be adopted. If they are adopted, they will have to be decoded before they are listed or printed. This involves much programing effort, not commensurate with the frequency of need for such listing.

In this experiment the listing has been done only for a few major heads for some reactors.

The work involved in this aspect of the experiment may be divided as:

1. Decision as to the layout of the lists; and

2. Programming to produce lists in accordance with the decided layout.

Decision as to the layout becomes necessary if the computer print outs have to be duplicated and circulated. It was decided to have a two column layout for the listing of data.

It was decided to start the subheads at the first indention and the specific heads at the second indention. In this way the context in which the specific heads occured would be given by the subhead.

The programming for listing of data involved the fetching from the disk, of data under a major head and printing out of these according to the specified format. Great care had to be taken to see that the format conformed rigidly with the decisions taken earlier.

The print out from the computer have been given in the appendix 6.

Conclusions

The above experiment is at best of an exploratory nature. The finer aspects of file organisation and file search have to be investigated. The method of storage adopted in this experiment is wasteful of disk storage, though it offers certain advantages at the time of search. Attempts should be made to evolve generalised methods of file storage and retrieval for specific facts or data.

Acknowledgements

The authors are grateful to the Director, Insdoc for providing computer facilities to them for the above work.

Block Diagram for Storage of Data on Disk

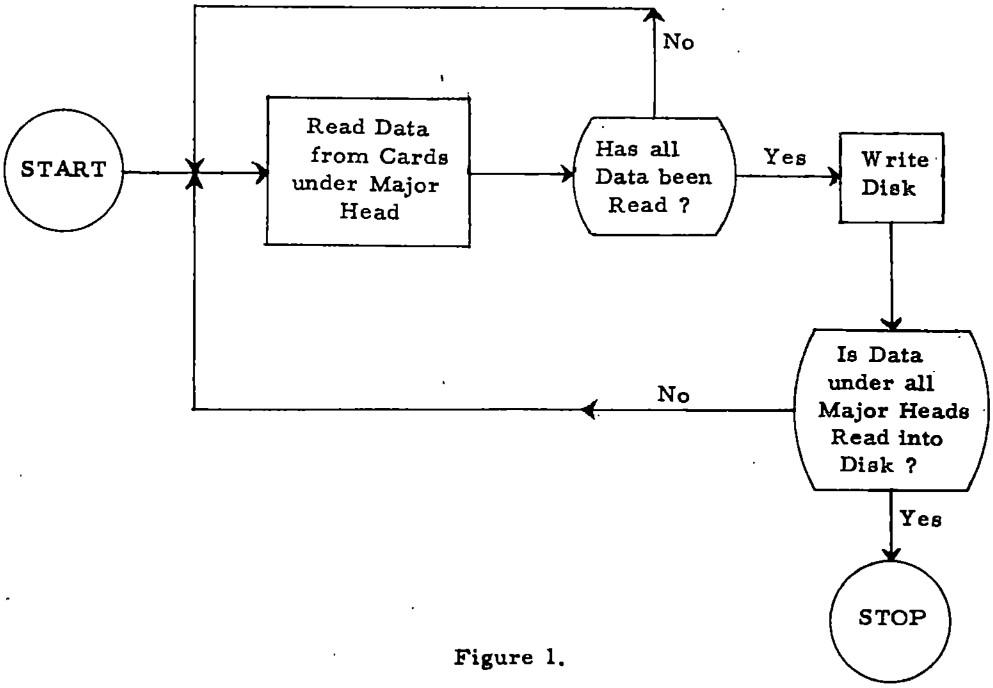

START
Read Data from Cards under Major Head
Has all Data been Read ?
No
Yes
Write Disk
Is Data under all Major Heads Read into Disk ?
No
Yes
STOP

Figure 1.

Block Diagram for Single Aspect Search Programme
(Aspect 'QUEST' is being searched in the file)

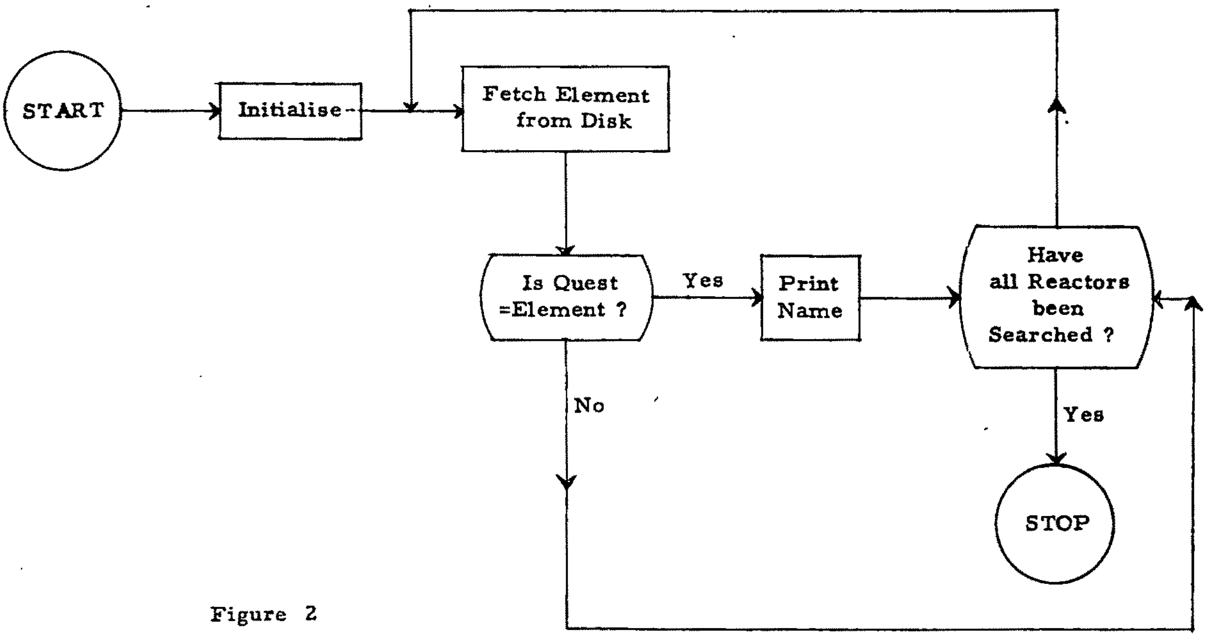


Figure 2

Block Diagram for Logical Product Search
(File Search for Aspects QUEST 1 and QUEST 2)

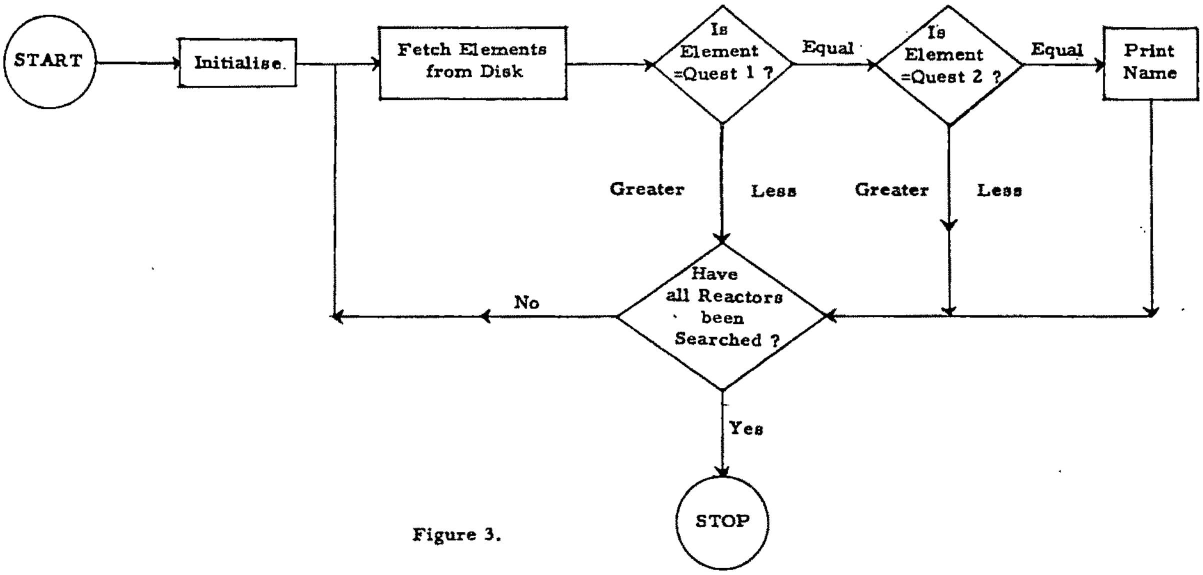


Figure 3.

Block Diagram for between the Limits Search Programme
(QUEST is being searched for limits LIM 1 and LIM 2)

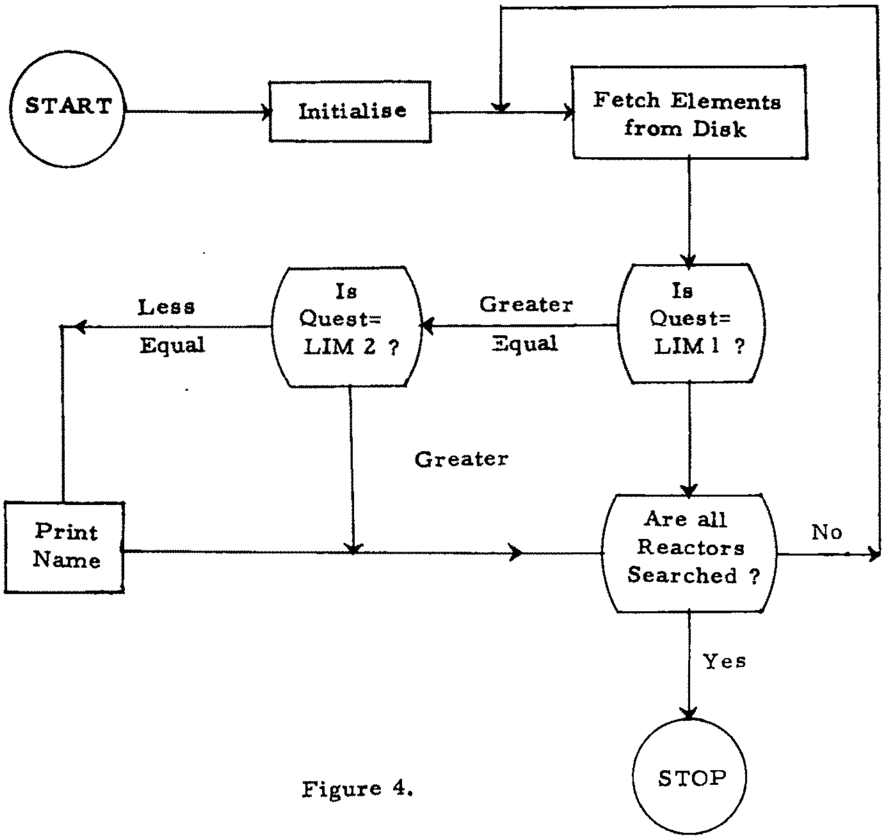


Figure 4.

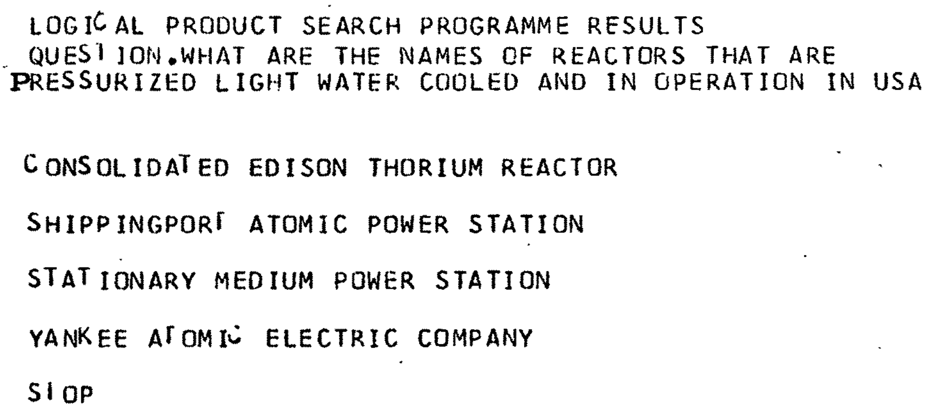
APPENDIX

```
SINGLE ASPECT SEARCH PROGRAMME RESULTS

REACTORS WITH CORE SHAPE = CYLINDER


FIRST ATOMIC POWER STATION OF THE USSR

VORONEZH ATOMIC POWER STATION

DRESDEN NUCLEAR POWER STATION
```

1. Single Aspect Search Results

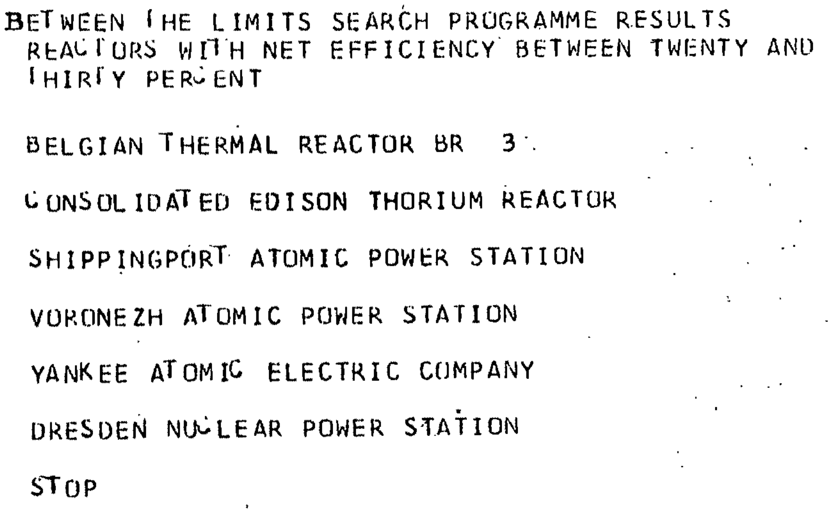
```
*FANDK1810
C      SEARCH PROGRAM
       DIMENSION Q1(3)
       DIMENSION Q2(2)
       DIMENSION GENER(19,8)
       PRINT 106
106    FORMAT(1X,40HLOGICAL PRODUCT SEARCH PROGRAMME RESULTS)
       PRINT 207
207    FORMAT(1X,48HQUESTION.WHAT ARE THE NAMES OF REACTORS THAT ARE/
      154HPRESSURIZED LIGHT WATER COOLED AND IN OPERATION IN USA//)
       DEFINE DISK(10,136)
       READ 131,Q1
131    FORMAT(3A8)
       READ 132,Q2
132    FORMAT(2A5)
       NN=1
       N=1
       II=5
       J=1
111    K=9+(N-1)*2
       FIND(K)
       FETCH(K)(GENER(I,J),I=1,19)
130    IF(GENER(II,J)-Q1(NN))11,12,11
11     N=N+1
       NN=1
       II=5
       J=J+1
       IF(N-8)111,111,112
112    STOP
12     II=II+1
       NN=NN+1
       IF(II-7)130,130,133
133    II=14
       NN=1
140    IF(GENER(II,J)-Q2(NN))11,145,11
145    II=II+1
       NN=NN+1
       IF(II-15)140,140,146
146    K=N
       FIND(K)
       FETCH(K)(RNAME(I,J),I=1,10)
       PRINT 147,(RNAME(I,J),I=1,10)
147    FORMAT(1X,10A5/)
       GO TO 11
       END
```

2. Programme for Logical Product Search



```
LOGICAL PRODUCT SEARCH PROGRAMME RESULTS
 QUESTION.WHAT ARE THE NAMES OF REACTORS THAT ARE
PRESSURIZED LIGHT WATER COOLED AND IN OPERATION IN USA

 CONSOLIDATED EDISON THORIUM REACTOR

 SHIPPINGPORT ATOMIC POWER STATION

 STATIONARY MEDIUM POWER STATION

 YANKEE ATOMIC ELECTRIC COMPANY

 STOP
```

3. Logical Product Search Results



```
BETWEEN THE LIMITS SEARCH PROGRAMME RESULTS
 REACTORS WITH NET EFFICIENCY BETWEEN TWENTY AND
 THIRTY PERCENT

 BELGIAN THERMAL REACTOR BR  3

 CONSOLIDATED EDISON THORIUM REACTOR

 SHIPPINGPORT ATOMIC POWER STATION

 VORONEZH ATOMIC POWER STATION

 YANKEE ATOMIC ELECTRIC COMPANY

 DRESDEN NUCLEAR POWER STATION

 STOP
```

4. Between the Limits Search Results

```
SHIPPINGPORT ATOMIC POWER STATION
                                          CORE DATA

SHAPE  CYLINDRICAL

DIMENSIONS
  DIAMETER/BREADTH  6.8 FT
  HEIGHT  6 FT
  LENGTH

NO OF CHANNELS
  FUEL
  CONTROL ROD
  FUEL ELEMENT
  SAFETY ROD

NO OF SUBASSEMBLIES  32
  FUEL ROD
  STATIONARY
  MOVEABLE

LATTICE
  SHAPE
  PITCH
    FUEL RODS
    SUBASSEMBLIES
  SPACING  6 INS

CRITICAL MASS  28.7 KG U235
AT(TEMPERATURE)  525 DEG F
```

```
NET EFFICIENCY  60 MW

CORE LOADING AT RATED POWER  75 KG U235

AVG SPECIFIC POWER IN FUEL  354 KW/KG

AVG POWER DENSITY IN CORE
  SEED  75 KW/I
  BLANKET  24.6 KW/I

BURN UP
  AVG
  MAX
  PERCENTAGE  11

REFUELLING SCHEDULE
  PARTIAL
  FULL  YES
  TIME INTERVAL  3000 HRS
  DOWN TIME

MODERATOR  LIGHT WATER
  WEIGHT/QUANTITY  70800 LITS
    IN CORE  2918 LITS
  AVG TEMP
  MAX TEMP

BLANKET GAS  NONE
```

```
                                  FUEL ELEMENT

FORM  SANDWICH PLATE TYPE
AT SEED BLANKET  SEED

DIMENSIONS
  DIAMETER
    INNER
    OUTER
  LENGTH  71.75 IN
  BREADTH  2.05 IN
  HEIGHT/THICKNESS  0.039 IN

NO.OF PELLETS/ROD/TUBE

ROD/TUBE DIMENSIONS
  DIAMETER
    INNER
    OUTER
  LENGTH

NO.OF PLATES/RODS/TUBES-
            PER ELEMENT  60

FORM  PELLETS ROD TYPE
AT SEED BLANKET  BLANKET

DIMENSIONS
  DIAMETER
    INNER
    OUTER
  LENGTH  0.358 IN
  BREADTH  0.349 IN
  HEIGHT/THICKNESS

NO OF PELLETS/ROD/TUBE

ROD/TUBE DIMENSIONS
  DIAMETER
    INNER
    OUTER
  LENGTH
```

```
TOTAL LENGTH

ACTIVE LENGTH

ENRICHMENT(PERCENTAGE)  93
  INNER REGION
  OUTER REGION

COMPOSITION(WT PERCENT)U 6.33,ZIRCALOY 93.67

CLADDING
  MATERIAL
    THICKNESS

CLADDING,SEED
  MATERIAL  ZIRCALOY
    THICKNESS  0.15IN

BONDING  METALLURGICAL

CLADDING BLANKET
  MATERIAL  ZIRCALOY
                                   THICKNESS  0.03IN

BONDING  HELIUM

SUBASSEMBLIES
  SHAPE OF ARRAY
  NO.OF RODS/TUBES IN ARRAY

DIMENSIONS OF ARRAY
  DIAMETER/BREADTH
  LENGTH
  HEIGHT

TOTAL LENGTH

ACTIVE LENGTH
```

5. Upper Limit Search Results

```
SHIPPINGPORT ATOMIC POWER STATION


                               GENERAL INFORMATION

REACTOR TYPE                                         NO OF REACTORS  I
  ENRICHMENT(PERCENTAGE)  93
  MODERATOR  LIGHT WATER                             NET EFFICIENCY(PERCENTAGE)  26.6
  COOLANT  PRESSURIZED LIGHT WATE:
                                                     LOCATION(COUNTRY)  USA
RATED UUTPUT PER REACTOR
  GROSS HEAT  225 MW                                 CONSTRUCTION SCHEDULE
  GROSS ELECT  67 MW                                   REACTOR CRITICAL  DEC 1957
  NET ELECT  60 MW                                     FJ LL POWER  PERATION  DEC 1957
  SELF CONSJMPTION  11.7

                                  CORE DATA

SHAPE  CYLINDRICAL                                   CORELOADING AT RATPOWFR  75 KG U235

DIMENSIONS                                           AV SPECIFICPOWER INFUEL
  DIAMETER/BREADTH  6.8 FT
  HEIGHT  6 FT                                       AVG POWER DENSITY IN CORE
  LENGTH                                               SEED
                                                       BLANKET
NO OF CHANNELS
  FUEL                                               BURN UP
  CPNTROL ROD                                          AVG  354 KW/KG
  FUEL ELEMENT                                         MAX
  SAFETY ROD                                           PERCENTAGE

NO OF SUBASSEMBLIES  32                              REFJELLING SCHEDUIE
  FUEL ROD                                             PARTIAL
  STATIONARY                                           FJLL
  MOVEABLE                                             TIME INTERVAL        75 KW/
                                                       DOWN TIME  1     24.6 K
LATTICE
  SHAPE
```

6. Listing of Data

DIRECTORY COMPILATION BY COMPUTER

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L J HARAVU
Indian Institute of Technology, New Delhi.

S N SUR
Insdoc, New Delhi–12.

Describes the processing of the 'Roster of Indian Scientific Translators'. Gives the coding and programming details along with the methodology. Points out the need for more programming effort to develop utility packets of generalised programmes.

INTRODUCTION

The directory has a special place as a reference tool. The compilation of the information for a directory is a time-consuming and laborious process. Further, the usefulness of such tools is short-lived, necessitating frequent revisions. The operations necessary for the compilation of a directory may be generalised as follows:

1. The collection of information;

2. The ordering of information into meaningful patterns generally consisting of a main or substantive part and supported by suitably ordered guides as approaches to the main body of information; and

3. The addition and/or deletion of information at intervals of time.

Once the information has been collected some of these operations are amenable to automation. In a computer produced directory the corresponding operations would be:

1. The creation of a secondary information file from the primary file of the collected information. The primary file could be on machine manipulable media such as punched cards, paper tape, magnetic tape or disks. Further this file could be in natural language image on these media or in a coded form or a combination of both;

2. The manipulation of such a file to produce readable copy by methods such as:(a) the merging of files, (b) the generation of subfiles, (c) the interpretation of coded information by dictionary look-up methods; and

3. The updating of information i.e. the interpolation and extrapolation of information and its subsequent manipulation.

It was with a view to acquiring experience in the above aspects of information processing that the Projects Division of INSDOC, using the computer facilities available to it, devised an experiment which has resulted in the publication of 'Roster of Indian Scientific and Technical Translators'[1]. It was felt that the information pertaining to translators in the country offered good material for such experimentation. An attempt is made in the rest of this article to describe the details of this work only.

INFORMATION COLLECTION

The information was collected using the questionnaire method. A questionnaire (Annexure 1) was circulated to research organizations, universities, colleges, individuals and industrial establishments. Advertisements in professional journals and daily newspapers in English, were made to attract the attention of individual translators. Over 3000 such questionnaires were mailed and the response over a period of eleven months was 630.

INFORMATION PREPARATION

The information collected in the questionnaire had to be converted into machine readable records [2]. For obvious reasons, all the information collected in the questionnaire could not be represented in natural language or in the form as found in the questionnaire. Suitable codes for the information collected were devised in order to ensure consistent representation of the data. It was decided that two punched cards using fixed field representation would suffice to represent the information on one questionnaire: (1) A Main Card (designated CERO MAIN) giving the details of the translator like his name, academic qualifications, subject of specialization, designation, foreign languages known, place of work etc; and (2) An address Card giving the translator's mailing address (designated CERO Address). The two cards punched for a translator were tied up by a common control number. The control number happened to be a serial number given to the completed questionnaire as these were received. The CERO MAIN card contained the name of the translator as such and codes for place of work, languages known etc. The CERO ADDRESS card contained the address of the translators as such.

CODING

Given in the next is the field allocation and the examples of the codes devised for the CERO MAIN card.

Conversion

The card designs for the CERO MAIN and CERO ADDRESS cards are reproduced in figures 1 and 2 respectively. The information on the questionnaire was then transcribed onto code sheets in accordance with the pre-determined card design. The code sheet forms an intermediate record to be used at the time of keypunching and verification. A sample of a code sheet is presented in fig. 3. The keypunching and verification was done using the IBM model 024 and IBM model 056 punch and verifier respectively. Thus made ready for manipulation on the computer.

FILE GENERATION

Three basic files generated on magnetic disk were:

1. The CERO MAIN file,

2. The CERO ADDRESS file, and

3. The Coded Dictionary containing the codes for the foreign languages and their verbal equivalents.

The CERO MAIN file was sequenced alphabetically by the name of the translator. The CERO ADDRESS file was sequenced serially by the control number (Card cols. 77-80). The Code Dictionary was sequenced alphabetically by the codes for the foreign languages. The Dictionary had one-to-one correspondence obviously to avoid homonyms.

FILE MANIPULATION

Since the final object of the experiment was the production of hard copies to be used for the photo-offset printing of a roster of translators, it was necessary to decide the form and content of the roster itself before the files could be manipulated to produce the hard copies.

ROSTER LAYOUT

It was felt that in order that the Roster may be an useful tool, access to the following information was necessary:

1. Name and address of the translator and the foreign language(s) known by him to be arranged alphabetically by the name. It was decided that this would constitute the main part of the Roster. When more than one language was known by the translator they would be reported in the same sequence as by the translator;

2. Names of translators to be arranged alphabetically under foreign languages known;

3. Names of translators available in the different towns and cities in the country. Along with the names it was decided to give in an abbreviated form the foreign languages known by each translator;

4. Names of translators under their subjects of specialization. Here again the foreign languages known was to be mentioned against their names. The Universal Decimal Classification was used to code the subjects of specialization. At the output stage it was decided to suppress the Class number and retain only the terms denoting the subject of specialization. In some cases, these terms were modified; and

5. It was decided to have a section on Indian Languages. Here the names of translators capable of translating from foreign into Indian Languages were listed.

Coding Table

Card Cols.	Item of information	Type of Code	Example of Code
1-20	Name of translator	Uncoded	
21	Blank	-	-
22	Highest degree	Numeric	Post graduate-3
23-26	Subject of degree	UDC Class No. upto 4 places	Mining-6219
27	Degree of specialisation	Numeric	Fellowship-6
28-31	Subject of specialisation	UDC Class No. upto 4 places	
32-33	Designation	Numeric	Scientist-11
34-35	State	Alphameric	Assam - AS
36	Town	Alphameric	Gauhati - G
37-38	Institution	Numeric	University-11
39-40	Foreign language	Alphameric	Russian - RU
41	Mode of study	Numeric	Foreign University-3
42	Experience in No. of pages	Numeric	101-500 pages Translated-4
43	Whether or not member of INSDOC panel of translators	Numeric	Yes - 1
44-45	Indian languages into which translator can translate from foreign language in col. 39-40	Alphameric	Hindi - H Oriya - O
46-52) 53-59) 60-66) 67-73)	Same as above from 39-45 respectively		
74	Blank		
75-76	Identification code	Alphameric	CERO MAIN CARD - TI
77-80	Serial No.	Uncoded	

In effect the Roster contained five sections corresponding to 1 to 5 above, viz (1) addresses of translators, (2) language specialization, (3) town-translator distribution, (4) subject specialization, and (5) Indian language expertise.

PROGRAMMING

The object was to write general programmes which could be used at a later date to produce other editions of the Roster if it was found useful.

The programmes written in order to produce the above sections of the Roster are discussed here under:

1. Programmes for the Main Part, and

2. Programmes for the Indexes.

MAIN PART

This part contained the name of the translator, his mailing address and foreign languages known in that order. The name and languages known were available as items in the CERO MAIN file while the address was available in the CERO ADDRESS file. In order to produce the main part it became necessary to selectively collate the information from these two files. Further, the information about languages known was in a coded form. This had to be de-coded at the time of output. This involved a dictionary look-up in the 'foreign language code - code equivalent dictionary'. In order to provide consulting ease in the printed page it was decided to print the name of the translator at the first indention, the address and languages known at the second indention.

Since the CERO MAIN file was ordered alphabetically by name, production of this part involved the fetching of each CERO MAIN record in sequence, finding the address using the common control number, and decoding the codes for the foreign languages known.

The flow chart for this programme is presented in figure 4. The listing (SPS - II D) is presented in annexure 2. A sample of the output is presented in annexure 3.

INDEXES

Producing the remaining parts of the Roster involved the searching of the CERO MAIN file for the presence of a given type of information, and printing the name of the translator only, or together with the foreign languages known by him without any decoding. Thus, for instance, in order to produce the Town-Translation distribution section of the Roster, the entire CERO MAIN file was searched once for each town (i.e. the presence of the code for the particular town in all the records of the CERO MAIN file). The town code and its equivalent were read from cards, one at a time and each of the CERO MAIN records was searched for presence of this particular code. On equivalence the name of the translator was printed out together with the foreign language codes. This could also have been done by sorting the CERO MAIN file by the town codes and printing out the names of the translators in each town (since the original ordering of the CERO MAIN file was alphabetical by translators name, the sub-sort by towns would still be alphabetical by translators name within a town). However, this method would take more time (with the file size of 630 records) on account of the sort that would first have to be done. The latter method was followed for printing the subject specialization part of the Roster. Samples of the indexes are reproduced in annexures 4 to 7.

OBSERVATIONS

There was a very poor response to the method of collecting information by means of a questionnaire. In our context it takes a considerable time to collect personal information.

It was observed that the use of UDC as such without any modification, for coding the information for computer manipulation, is not a practically feasible on IBM 1620 computer. Further, the use of Roman letters for deriving code words presented some difficalty at the manipulation stage of the file on the magnetic discs. The use of Indo-Arabic Numerals as the base for code word offered considerable ease in the file manipulations.

CONCLUSIONS

This experiment provides a better understanding of the work involved in the compilation of a directory. It also indicates that a greater programming effort should be devoted to evolve generalised programmes for the computerised processing of the information with a view to produce a directory. In fact, the Cell has now gained sufficient experience to write utility packet of programmes for documentation processing. Such a packet programme will immensely benefit the institutions having the IBM 1620 data Processing System. The Cell must try to gain experience in handling large volume of information.

ACKNOWLEDGEMENTS

The authors wish to record their grateful thanks to Shri B.S. Kesavan, Director, Insdoc, for providing the necessary facilities, and to Shri S. Parthasarathy and to Shri M.S. Dandekar for their active participation and help.

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[1] Roster of Indian scientific and technical translators. Insdoc, New Delhi, 1967.

[2] Raizada, A S and Khanna, Meena: Preparation of information for processing by computer. Ann Lib Sci Doc 1967, 14(1), 1-8.

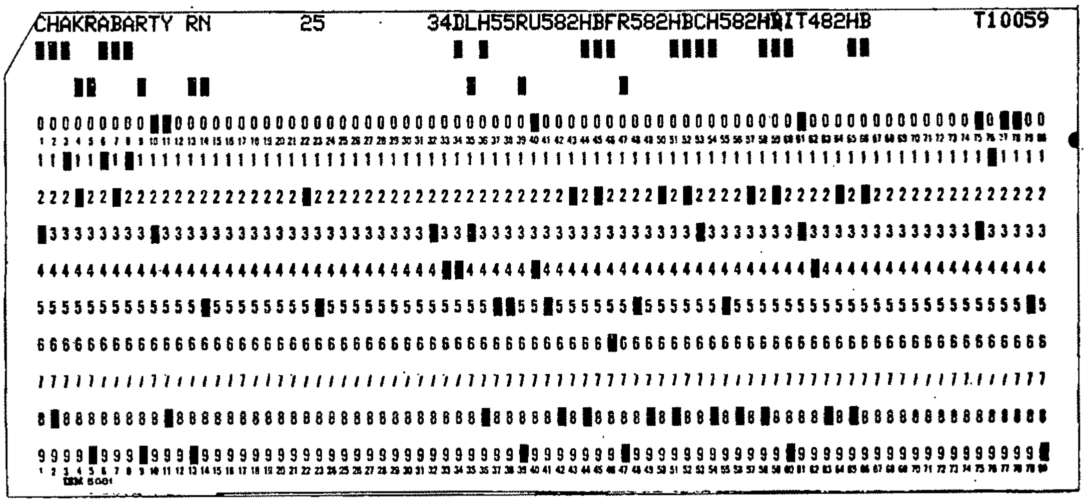


Fig. 1. Card Design for the CERO MAIN

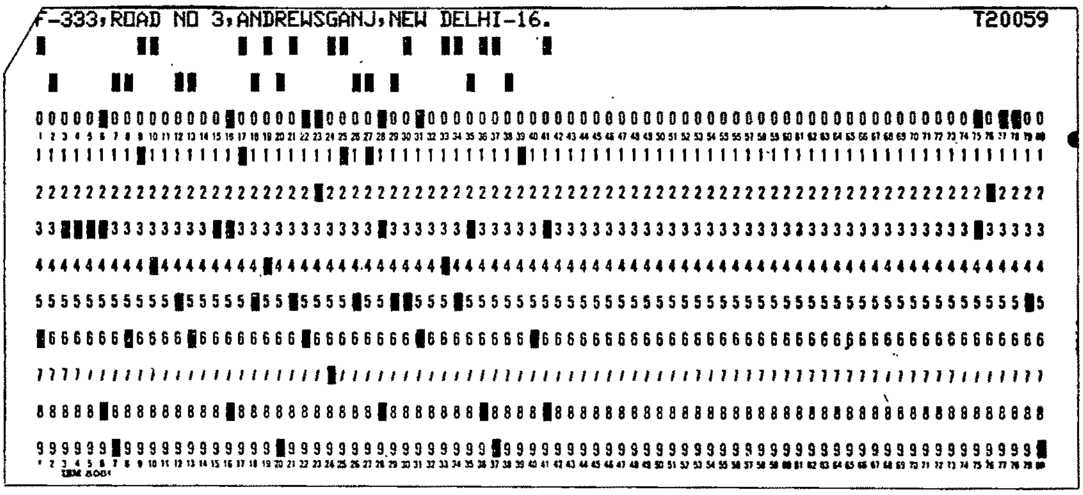
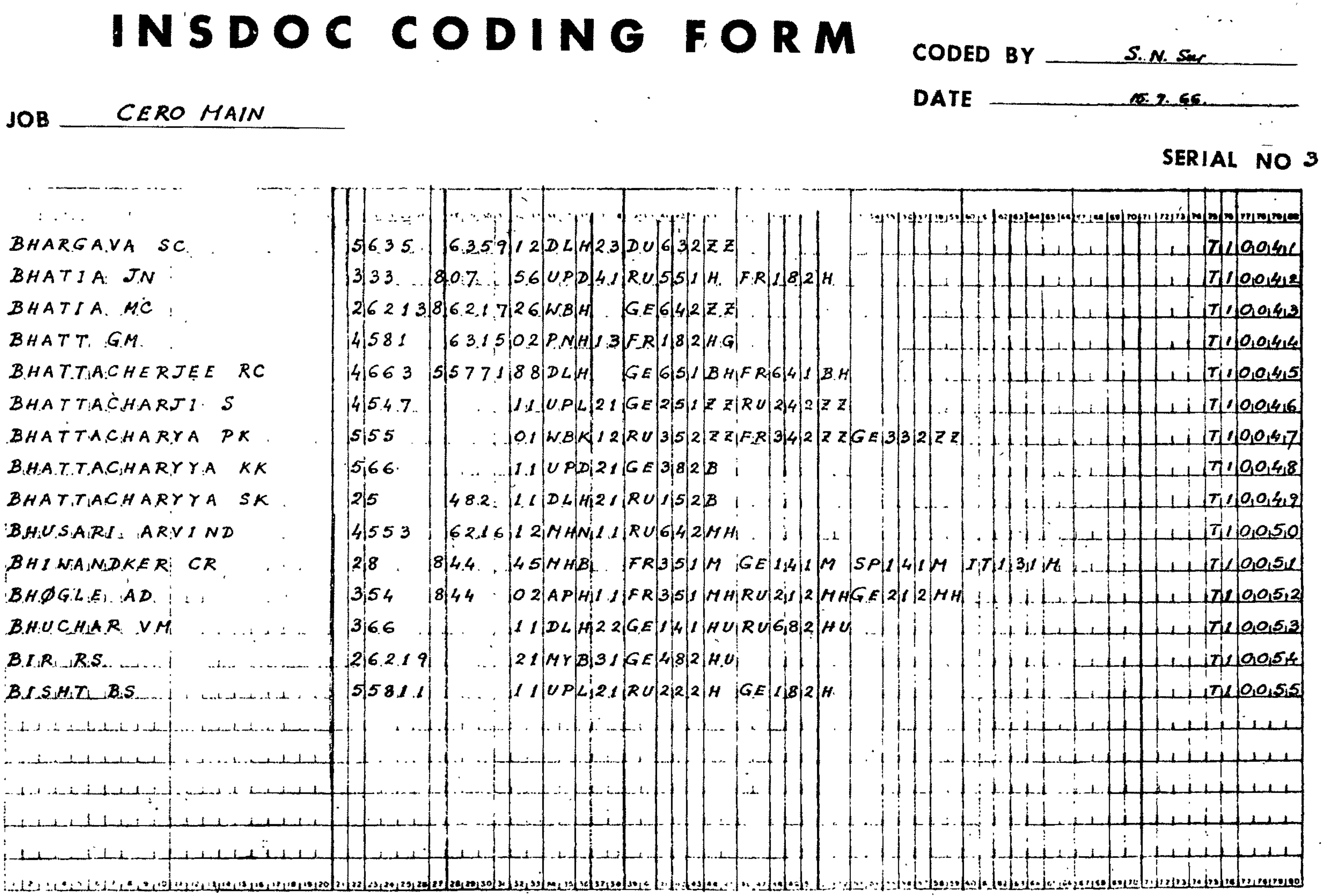


Fig. 2. Card Design for the CERO ADDRESS



INSDOC CODING FORM

CODED BY S. N. Sur

DATE 15.7.66.

JOB CERO MAIN

SERIAL NO 3

BHARGAVA SC	5635	6359	12	DLH	23	DU 632 ZZ				T1	0041
BHATIA JN	333	807	56	UPD	41	RU 551 H	FR 182 H			T1	0042
BHATIA MC	26213	86217	26	WBH		GE 642 ZZ				T1	0043
BHATT GM	4581	6315	02	PNH	13	FR 182 HG				T1	0044
BHATTACHERJEE RC	4663	55771	88	DLH		GE 651 BH	FR 641 BH			T1	0045
BHATTACHARJI S	4547		11	UPL	21	GE 251 ZZ	RU 242 ZZ			T1	0046
BHATTACHARYA PK	555		01	WBK	12	RU 352 ZZ	FR 342 ZZ	GE 332 ZZ		T1	0047
BHATTACHARYYA KK	566		11	UPD	21	GE 382 B				T1	0048
BHATTACHARYYA SK	25	482	11	DLH	21	RU 152 B				T1	0049
BHUSARI ARVIND	4553	6216	12	MHN	11	RU 642 MH				T1	0050
BHINANDKER CR	28	844	45	MHB		FR 351 M	GE 141 M	SP 141 M	IT 131 H	T1	0051
BHØGLE AD	354	844	02	APH	11	FR 351 MH	RU 212 MH	GE 212 MH		T1	0052
BHUCHAR VM	366		11	DLH	22	GE 141 HU	RU 682 HU			T1	0053
BIR RS	26219		21	MYB	31	GE 482 HU				T1	0054
BISHT BS	55811		11	UPL	21	RU 222 H	GE 182 H			T1	0055

Fig. 3. Sample of a Code Sheet

TRANSLATORS ROSTER [Flow Chart: Output Programme]

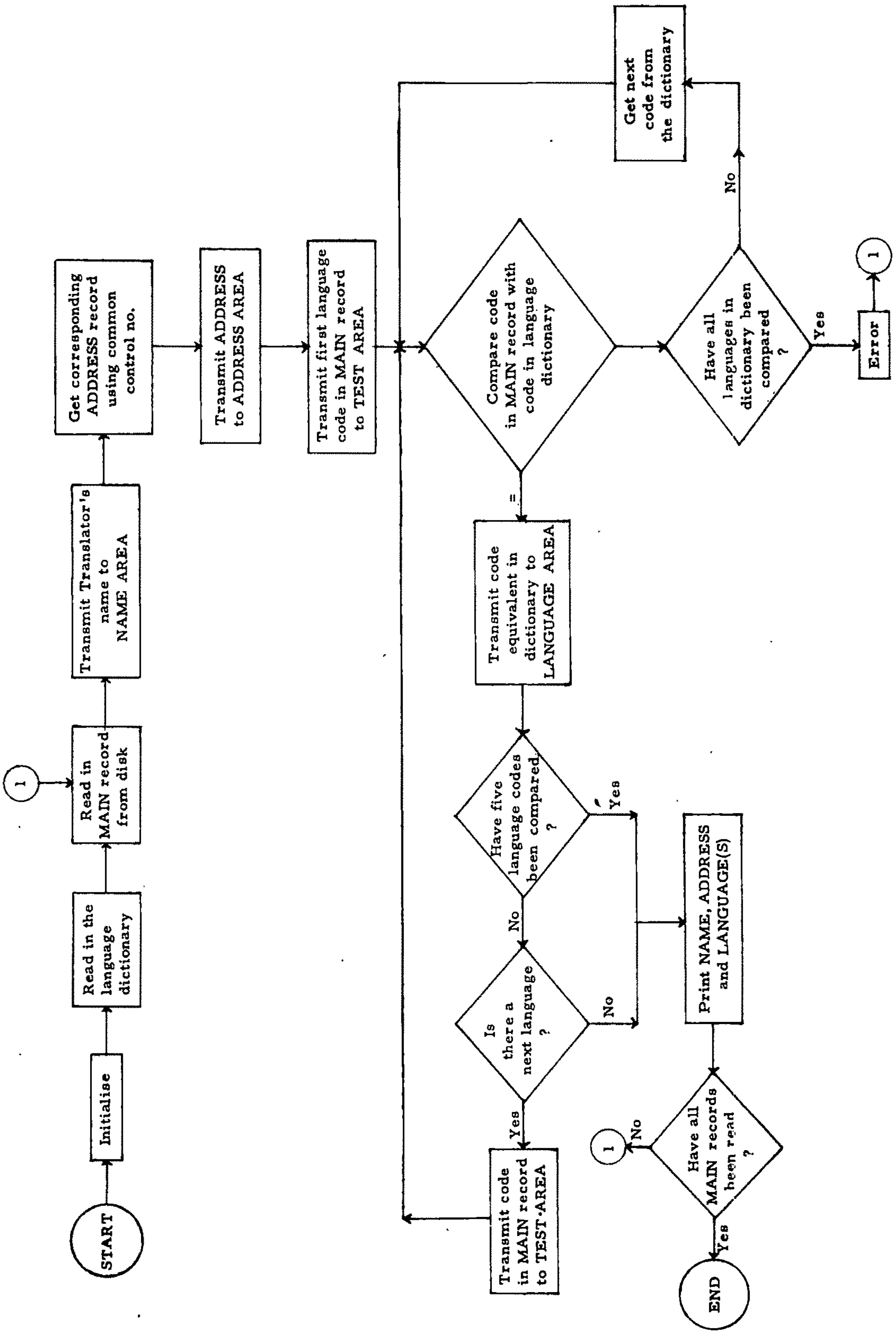

START
Initialise
Read in the language dictionary
1
Read in MAIN record from disk
Transmit Translator's name to NAME AREA
Get corresponding ADDRESS record using common control no.
Transmit ADDRESS to ADDRESS AREA
Transmit first language code in MAIN record to TEST AREA
Compare code in MAIN record with code in language dictionary
=
Have all languages in dictionary been compared ?
No
Get next code from the dictionary
Yes
Error
1
Transmit code equivalent in dictionary to LANGUAGE AREA
Have five language codes been compared ?
Yes
No
Is there a next language ?
No
Yes
Transmit code in MAIN record to TEST-AREA
Print NAME, ADDRESS and LANGUAGE(S)
Have all MAIN records been read ?
No
1
Yes
END

Fig. 4. Flow Chart of Programme

Annexure 1. Showing both sides of the Registration Card

REGISTRATION FORM

CENTRAL ROSTER OF SCIENTIFIC TRANSLATORS

1. **Name** ________________ 2. **Date of birth** __________

3. **Mailing Address** ________________________

4. **Employment**
   (a) Where employed ________________
   (b) Designation ________________

5. **Highest Academic Qualification/Degree** __________
   Subjects Studied ________________

6. **Special Qualification/Degree/Diploma** __________
   Subject of Specialisation ________________

7. **Foreign Languages Known (other than English)** __________
   (Give details in the table given overleaf)

8. **Are you translating at present?**
   If yes, mention the language ________________

9. **How do you keep yourself in touch with language(s) known?**
   By Reading ☐ By Translation ☐
   By Helping Your Colleagues ☐ By Writing ☐

10. **Membership of any Translators'/Linguistic Society** __________

11. **Signature** ________________

P. T. O.

7. Foreign Languages Known (Other than English)

Language	Training			Ability to Translate (Good, Fair, Poor)			Give no. of pages translated (300 translated words make one page)	Capacity No. of hours per week that can be spared for translation	Are you a member of INSDOC PANEL
	Place of Study (Put ST for Self Taught)	Dip./Cert. with Year of Passing	Duration of Study	Into English	Into Indian Lang.				
					Lang.	Ability			

Annexure 2. Output Programme Listings (SPS-II D).

```
  *TRANSLATORS ROSTER OUTPUT PROGRAM
171BLANK DC  4,0
 10KOUNT DC  2,0
 20COUNT DC  2,0
 61PRTKNTDC  2,0
 30DCF   DDA ,3,23000,2,MAIN-1
 40DCF1  DDA ,3,0,2,ADRESS-1
 50DCF2  DDA ,3,29000,1,DICT-1
 51DCF3  DDA ,3,0,1,NAME-1
 60MAIN  DAS 100
 70ADRESSDAS 100
 80DICT  DAS 50
 90NAME  DAS 50
100SPACESDC  50,0
110LANG  DAS 100
120RECMK DAC 1,@
130CONST DC  5,25998
140NUMBERDC  4,0
141SECTADDC  5,0
142NUMB  DC  3,0
150ZERO  DC  8,0
160STARTRDC  2,24
170RESTERDC  2,04
180COMMA DC  2,23
190INDEX DSA 0
200KNTR  DC  3,0
210START SK  DCF
220      RDN DCF
230      SF  MAIN-1
240      TF  NAME+38,MAIN+38
241      TF  NAME+40,RECMK
242      TF  NAME+98,SPACES
243      TF  NAME+48,ZERO
250      SF  MAIN+151
260      TNS MAIN+158,NUMBER
270      TF  DCF1+5,NUMBER
280      CF  DCF1+2
281      SF  DCF1+1
290      A   DCF1+5,DCF1+5
300      A   DCF1+5,CONST
310      SK  DCF1
320      RDN DCF1
330      TF  ADRESS+122,RECMK
340      SK  DCF2
350      RDN DCF2
360SFLAG SF  MAIN+75
370      AM  SFLAG+6,14
380      AM  COUNT,1,10
390      CM  COUNT,5,10
400      BL  SFLAG
410RESET SF  DICT-1
420      SF  DICT+3
430TEST  C   DICT+2,MAIN+78,7
440      BE  RETAIN
450      AM  DCF2+5,1
460      SK  DCF2
470      RDN DCF2
480      B7  RESET
490RETAINTF  LANG+4,STARTR
500TRANS TD  LANG+5,DICT+3,27
510BACK  AM  TRANS+11,1
520      AM  TRANS+6,1
530      BD  AGAIN,-TRANS-11
```

```
540      TF  INDEX,TRANS+6
550      AM  INDEX,1
560      TF  -INDEX,COMMA
561      TNS DICT+48,SECTAD
562      TF  DCF3+5,SECTAD
563      SF  DCF3+1
564      SK  DCF3
565      WDN DCF3
566      CDN DCF3
567      AM  SECTAD,1
568      TNF DICT+48,SECTAD
569      TNS DICT+38,NUMB
571      AM  NUMB,1,9
572      TNF DICT+38,NUMB
573      CF  DICT-1
574      CF  DICT+3
575      SK  DCF2
576      WDN DCF2
577      CDN DCF2
570      AM  TEST+11,11
580      BD  SECOND,-TEST-11
590      TF  -INDEX,RESTER
591      AM  INDEX,2
592      TF  -INDEX,RECMK
593      TF  LANG+2,BLANK
594      TF  ADRESS-2,BLANK
600      PRA NAME
610      PRA ADRESS-4
  2      SPAP,2
620      PRA LANG
         AM  PRTKNT,1,10
   COMP1 CM  PRTKNT,10,10
         BNE CONT1
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         TFM PRTKNT,0,10
         TFM COMP1+11,14
         TFM COMP2+11,14
         TFM COMP3+11,14
621CONT1 AM  KNTR,1,9
622      CM  KNTR,603,9
623      BE  HALT
630      TFM SFLAG+6,MAIN+75
640      TFM TEST+11,MAIN+78
650      TFM COUNT,0
660      TFM DCF2+5,29000
670      TFM TRANS+11,DICT+3
689      TFM TRANS+6,LANG+5
690      AM  DCF+5,2
691      TFM DCF1+5,0
700      B7  START
710AGAIN TD  -TRANS-6,-TRANS-11
720      B7  BACK
730SECONDTFM DCF2+5,29000
731      TFM TRANS1+11,DICT+3
740      SK  DCF2
750      RDN DCF2
760      AM  TEST+11,3
```

```
770TEST1 SF   DICT-1
780      SF   DICT+3
790      C    DICT+2,-TEST-11
800      BE   KEEP
810      AM   DCF2+5,1
820      SK   DCF2
830      RDN  DCF2
840      B7   TEST1
850KEEP  AM   TRANS+6,2
860TRANS1TD   -TRANS-6,DICT+3,7
870BACK1 AM   TRANS+6,1
880      AM   TRANS1+11,1
890      BD   AGAIN1,-TRANS1-11
900      TF   INDEX,TRANS+6
910      AM   INDEX,1
920      TF   -INDEX,COMMA
921      TNS  DICT+48,SECTAD
922      TF   DCF3+5,SECTAD
923      SF   DCF3+1
924      SK   DCF3
925      WDN  DCF3
926      CDN  DCF3
927      AM   SECTAD,1
928      TNF  DICT+48,SECTAD
929      TNS  DICT+38,NUMB
931      AM   NUMB,1,9
932      TNF  DICT+38,NUMB
933      CF   DICT-1
934      CF   DICT+3
935      SK   DCF2
936      WDN  DCF2
937      CDN  DCF2
930      AM   KOUNT,1,10
940      CM   KOUNT,4,10
950      BE   OVER
960      AM   TEST+11,11
970      BD   SECOND,-TEST-11
980      TF   -INDEX,RESTER
591      AM   INDEX,2
592      TF   -INDEX,RECMK
595      TF   LANG+2,BLANK
596      TF   ADRESS-2,BLANK
981      PRA  NAME
982      PRA  ADRESS-4
 1A      SPAP,2
983      PRA  LANG
         AM   PRTKNT,1,10
   COMP2 CM   PRTKNT,10,10
         BNE  CONT2
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         TFM  PRTKNT,0,10
         TFM  COMP1+11,14
         TFM  COMP2+11,14
         TFM  COMP3+11,14
984CONT2 AM   KNTR,1,9
985      CM   KNTR,603,9
986      BE   HALT
987      TFM  SFLAG+6,MAIN+75
988      TFM  TEST+11,MAIN+78
989      TFM  TRANS+6,LANG+5
990      TFM  TRANS+11,DICT+3
991      TFM  COUNT,0,10
992      TFM  KOUNT,0,10
993      TFM  DCF2+5,29000
994      AM   DCF+5,2
995      TFM  TRANS1+11,DICT+3
692      TFM  DCF1+5,0
996      B7   START
997AGAIN1TD   -TRANS-6,-TRANS1-11
998      B7   BACK1
999OVER  TF   -INDEX,RESTER
591      AM   INDEX,2
592      TF   -INDEX,RECMK
597      TF   LANG+2,BLANK
598      TF   ADRESS-2,BLANK
101      PRA  NAME
102      PRA  ADRESS-4
  3      SPAP,2
103      PRA  LANG
         AM   PRTKNT,1,10
   COMP3 CM   PRTKNT,10,10
         BNE  CONT3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         SPIM,3
         TFM  PRTKNT,0,10
         TFM  COMP1+11,14
         TFM  COMP2+11,14
         TFM  COMP3+11,14

104CONT3 AM   KNTR,1,9
105      CM   KNTR,603,9
106      BE   HALT
107      TFM  SFLAG+6,MAIN+75
108      TFM  TEST+11,MAIN+78
111      TFM  TRANS+6,LANG+5
112      TFM  TRANS+11,DICT+3
113      TFM  COUNT,0,10
114      TFM  KOUNT,0,10
115      TFM  DCF2+5,29000
116      TFM  TRANS1+11,DICT+3
117      AM   DCF+5,2
693      TFM  DCF1+5,0
118      B7   START
119HALT  CALLEXIT
121      DENDSTART
```

Annexure 3. Sample Output of the Main Part

addresses of translators

```
ABDULRAHMAN PM
  STRUCTURAL ENGNG RES CENTRE,ROORKEE(UP).
  (GERMAN)

ABDUR RAHIM R
  DES DEPT,HINDUSTAN MACHINE TOOLS LTD,BANGALORE-31.
  (GERMAN)

ABIDEEN SZ
  HINDUSTAN PHOTO FILMS LTD,OOTACAMUND(MADRAS).
  (GERMAN,FRENCH)

ACHARYA N
  B-235,SECTOR 6,PO ROURKELA-2.
  (GERMAN)

ADKE SR
  425/5,GULTEKADI,POONA-9.
  (GERMAN)

AGARWAL CP
  DEF COORDINATION UNIT,CSIR,RAFI MARG,NEW DELHI-1.
  (JAPANESE)

AGGARWAL NK
  RLY QR NO 12437,BLOCK T/34,RLY STN SUBZIMANDI,DELHI-7.
  (GERMAN)

AHLUWALIA RS
  MODERN EUROPEAN LANGUAGES DEPT,UNIV OF DELHI,DELHI.
  (ITALIAN,SPANISH,GERMAN)

AHMAD AJ(MRS)
  C/O S M AHMAD,ZARAFSHAN,DODHPUR,ALIGARH.
  (RUSSIAN,FRENCH,SPANISH,DUTCH,POLISH)

ALEXANDER AV
  DES AND DRAWING OFFICE,AUTO DIV,TELCO,JAMSHEDPUR-4.
  (GERMAN)
```

Annexures 4 & 5. Sample Pages of Subject Specialisation and Language Specialisation indexes

subject specialisation

```
   HUMANITIES

ANNAPURNI(MRS)
  (GE,FR)
ARORA J
  (RU)
AROUL G
  (SP)
DAS A
  (CH)
KANTA N (MRS)
  (RU)
KAUSHIK VP
  (RU,GE,FR)
KAWISHWAR GR
  (GE)
KHARDIKAR AB
  (RU)
KHURANA RC
  (FR,RU)
MUKHERJEE B
  (FR,GE)
NATH A
  (RU)
NAZIR AHMED VS
  (FR)
PANDHER SS
  (RU)
RAUT AR
  (GE,FR)
SAXENA HC
  (GE)
VENKATESH R
  (GE,FR)
VERMA HC
  (RU)


   PSYCHOLOGY

ASTHANA HS
  (GE)
BALASUBRAMANIAN KMRS
  (RU)
KRISHNAMURTHY P
  (GE)
MISRA RK
  (GE)
MOHANI MS
  (FR)
OJHA JM
  (GE,RU)
```

```
   PHILOSOPHY

LAZARE
  (FR)
LOOMBA RM
  (GE,FR)
RAO VS(MRS)
  (GE)
SUNDARAM VK(MRS)
  (RU,GE)


   SOCIAL SCIENCES

BALAMBAL VN(MISS)
  (RU,JP)
BHATKAR VM (MRS)
  (RU)
DESHMUKH MG
  (FR,GE,RU)
SUBRAMANYAN S
  (FR,RU)


   STATISTICS

ADKE SR
  (GE)
MADHAVAN S(MRS)
  (RU,FR)
RAMACHANDRA PV
  (FR,GE)
SUBRAHMANYAN TV
  (GE)


   POLITICAL SCIENCE

CHOWDHURY SP
  (RU,IT,GE,SA)
DEENADAYALU C
  (GE,FR)


     ECONOMICS

BHATIA JN
  (RU,FR)
```

```
GANANATHAN VS
  (GE)
KAPOOR PN
  (RU)
MISRA BP
  (FR,IT)
ROWE AV
  (SP,FR,IT)


    LANGUACES

BASU RADHARAMAN
  (FR,GE)
CHAPEKAR RN
  (GE)
CLAIRON G(MISS)
  (FR,IT,SP,VI,GE)
DANDEKAR MS
  (GE,FR,JP,IT,RU)
DAS G(MME)
  (FR)
DEY S
  (SP,IT,GE)
GANESHSUNDARAM PC
  (GE,RU,FR,SP,IT)
GHOSH ND
  (FR,SP,GE,RU,IT)
GUPTA ASHA(MRS)
  (RU)
NAIR JS(MRS)
  (FR)
RAY G(MRS)
  (GE,RU)
SARMA VSN
  (GE,RU,SP,FR)
VARADACHARI V
  (FR,GE)


   SCIENCES(GRADUATES)

AGGARWAL NK
  (GE)
BADAMI VN
  (RM)
BAHADUR BN
  (GE,FR)
BALAKRISHNAN S
  (RU)
BALASUBRAMANIAN K
  (FR,RU)
```

language specialisation

```
    ARABIC

HUSSAIN ISHTIAQ
JANI MA
MADVI H


   BURMESE

MURTY KS


   BULGARIAN

GUPTA PC


   CHINESE

CHAKRABARTY RN
DAS A
ROY CHOWDHRY JP


   CZECH

CHAKRABORTY AR
DEB SK
KAUL JL
MURTHY MSN
REJ D
SINGH C
THADANI HK
TRIVEDI BM


   DANISH

PANDA A


  DUTCH

AHMAD AJ(MRS)
BHARGAVA SC
CHARI MSR
MENON PG
VENKATARAMAN PK
```

```
     FRENCH

ABIDEEN SZ
AHMAD AJ(MRS)
ALI SM
ANNAMALAI PL
ANNAPURNI(MRS)
ARORA SK
ARYA HC
BAGCHIE MC
BAHADUR BN
BAIS AP
BALASUBRAMANIAN K
BANNUR BB
BASU RADHARAMAN
BASU SN
BHARADWAJ RK
BHARGAVA VM
BHARUCHA FR
BHASKARAN R
BHATIA JN
BHATIA SK
BHATT GM
BHATTACHARYA PK
BHATTACHERJEE RC
BHIWANDKER CR
BHOGLE AD
BHUGRA RB
BONET JV
BOSE BN
CHADHA KG
CHAKRABARTY RN
CHAKRABORTY AR
CHAKRAVARTI NC
CHAKRAVORTY RC
CHANDRA ISHWAR
CHANDRA SK
CHATTERJI NN
CHAUDHARY JL
CHAUDHURI SK
CHAUHAN KS
CHINNAIAH A
CHIVATE MR
CHOPRA SD
CLAIRON G(MISS)
DANDEKAR MS
DANG K(MRS)
DAS B
DAS G(MME)
DAS PC
DAS SS
DASGUPTA P
DASGUPTA SS
DAVE MJ
DAYAL R
DEENADAYALU C
```

```
DESHMUKH MG
DESHPANDE BR
DESHPRABHU CN
DESIKAN PS
DHAVALE DD(MISS)
DHILLON RS
DSOUZA T(MISS)
DURAIRAJ G
DUTT S
FREITAS YM
GAI BS
GANDHI M(MISS)
GANDHI MH(MISS)
GANESHSUNDARAM PC
GANGOLI SG
GANGOPADHYAY AK
GARDE VD
GHOSH A
GHOSH ND
GHOSH S
GHOSH SK
GIDVANI DS(MISS)
GIRI SHANKAR K
GODE PK(MRS)
GOEL R
GOEL RK
GOKHALE BG
GOPAL NGS
GOPALA KRISHNAN NS
GOYAL VB
GULATI IB
GUPTA AN
GUPTA PL
GUPTA RK
GUPTA SC
HARAVU K(MISS)
HARI MOHAN
HONMODE JAYANT
HUSAIN SI
HUSAIN SS
HUSSAIN ISHTIAQ
JAIN JD
JAIN PC
JATHAUL SB
KANTAK UN
KANTAN SK
KAPIL RP
KARMAKAR SK
KASHYAP SK
KAUSHIK VP
KHARE LR
KHURANA RC
KHURANA RS
KORKHAO JM
KRISHNAMURTHY MV
KRISHNAMURTHY R
```

Annexures 6 & 7. Sample Pages of Town-Translator
Distribution and Indian Language
Expertise indexes

town-translator distribution

```
   AGRA

GHOSH ND
  (FR,SP,GE,RU,IT)
RAIZADA SB
  (GE,FR)



   AHMEDABAD

BHARUCHA RR(MRS)
  (RU)
GANDHI MH(MISS)
  (FR)
IYER BV
  (GE)
PANDEYA SC
  (IT)
PARIKH VR
  (FR)
SARMA RS
  (GE)
SHAH CK
  (GE)
SHAH GS
  (GE)
TRIVEDI BM
  (CZ)
VAIDYA BS
  (FR)



   AJMER

BAIS AP
  (GE,FR)



   AKOLA

HONMODE JAYANT
  (RU,FR)



   ALIGARH

AHMAD AJ(MRS)
  (RU,FR,SP,DU,PL)
```

```
GANGOLI SG
  (FR)
JANI MA
  (GE,AR)
MATHUR RK
  (IT)



   ALLAHABAD

HARI MOHAN
  (FR)
MISRA RK
  (GE)
SENGUPTA SC
  (RU,GE,FR,IT,SP)



   ANKLESWAR

GUPTA RK
  (GE,RU,FR,IT)



   ANNAMALAINAGAR

DURAIRAJ G
  (GE,FR)
GOVINDAN P
  (GE)
MAHADEVAN A
  (FR,GE,RU)



   AURANGABAD

KRISHNAMURTHY R
  (FR)
SALANKI AS
  (GE)

   BANGALORE

ABDUR RAHIM R
  (GE)
BIR RS
  (GE)
BOSE TK
  (GE)
```

```
CHINNAIAH A
  (FR)
CLAIRON G(MISS)
  (FR,IT,SP,VI,GE)
DESHPRABHU CN
  (FR)
GADRE NIRMALAM(MRS)
  (GE)
GANESHSUNDARAM L MRS
  (RU)
GANESHSUNDARAM PC
  (GE,RU,FR,SP,IT)
GANGOPADHYAY AK
  (GE,FR,SW)
GURUMURTHY CV
  (GE)
HANDA MK
  (GE)
IYENGAR KTS
  (GE)
KALIDASS KS
  (RU,GE)
LAKSHMINARAYANAN R
  (FR,GE)
NARAYANAMURTI D
  (GE)
RAJANIKANTH AS
  (FR)
RAO NARASIMHA PL
  (GE)
SANKARAN T
  (FR,GE)
SEETHARAM BC
  (FR,IT)
SETTY VAS
  (IT)
SRINIVASAN V
  (GE,RU)
SUBRAMANIAN MS
  (FR,GE,RU)
SUBRAMANIAN NR
  (FR)
THADANI HK
  (CZ)
VENKATARAMAN NS
  (GE,RU)
VENUGOPALAN M
  (GE)



   BARODA

MEHTA DR
  (GE)
```

indian language expertise

```
   ASSAMESE

CHOWDHURY SN
  (IT)
DEKA PJ
  (RU)
MAHAPATRA UD
  (GE,RU)



   BENGALI

BAGCHIE MC
  (RU,FR,GE,SP,IT)
BANERJEE AR
  (GE,RU)
BANERJEE RK
  (GE)
BASU D
  (GE,RU)
BASU P
  (GE)
BASU RADHARAMAN
  (FR,GE)
BASU SN
  (FR)
BHAR RAMALA(MISS)
  (GE,RU)
BHATTACHARYYA KK
  (GE)
BHATTACHARYYA SK
  (RU)
BHATTACHERJEE RC
  (GE,FR)
BOSE BN
  (FR)
BOSE H
  (RU,GE)
BOSE TK
  (GE)
CHAKRABARTY RN
  (RU,FR,CH,IT)
CHAKRABORTY AK
  (GE)
CHAKRABORTY AR
  (RU,FR,GE,UK,CZ)
CHAKRAVARTI NC
  (FR,RU)
CHAKRAVARTY R
  (RU)
CHAKRAVORTY RC
  (FR)
CHANDRA SK
  (RU,FR)
```

```
CHATTERJEE SK
  (RU)
CHATTERJI NN
  (RU,FR,GE)
CHAUDHURI A
  (RU)
CHAUDHURI SK
  (JP,FR)
CHOWDHURY SN
  (IT)
CHOWDHURY SP
  (RU,IT,GE,SA)
DAS A
  (CH)
DAS B
  (RU,FR,GE,SP,IT)
DAS PC
  (GE,FR)
DAS SS
  (FR)
DASGUPTA P
  (FR,GE,RU)
DASGUPTA SS
  (GE,FR)
DATTA NC
  (RU)
DAW AN
  (GE)
DE PL
  (GE)
DEB SK
  (CZ,GE)
DEKA PJ
  (RU)
DEY S
  (SP,IT,GE)
DHAR BHOWMI KP
  (RU)
DUTT JP
  (RU)
GANGOPADHYAY AK
  (GE,FR,SW)
GHOSE JL
  (GE)
GHOSE KP
  (RU,GE)
GHOSH A
  (GE,FR)
GHOSH AK
  (GE)
GHOSH ND
  (FR,SP,GE,RU,IT)
GHOSH R
  (JP,IT)
```

```
GHOSH S
  (FR)
GHOSH SB
  (RU)
GHOSH SK
  (FR)
GHOSHAL AK
  (GE)
GHOSHDASTIDAR AB
  (RU)
GOSWAMI AK
  (GE)
GUPTA AN
  (RU,GE,FR)
GUPTA SK
  (RU)
HANDA R(MISS)
  (GE)
KARMAKAR SK
  (FR)
KUNDU JS
  (FR)
MAHAPATRA UD
  (GE,RU)
MAITRA AK
  (RU,FR)
MANDAL G
  (RU)
MITRA RN
  (GE)
MOJUMDER BN
  (RU)
MUKHERJEE B
  (FR,GE)
MUKHERJI NL
  (FR,GE)
MUKHERJI VP
  (GE,FR)
NAG B
  (RU,FR)
PAL B
  (GE,FR)
PAL SP
  (RU)
PANDA A
  (SW,DA)
PANDIT SN
  (GE)
RAKSHIT HN
  (GE,SP,FR)
RAY BK
  (GE)
RAY RK
  (GE)
```

CURRENT DOCUMENTATION LITERATURE

LIST OF PERIODICALS COVERED IN THIS ISSUE

Note: Volume and issue numbers have been mentioned in each case.

ALA Bulletin [ALA Bull]	61(3,4,5)
American Documentation [Am Doc]	18(1,2)
Annals of Library Science and Documentation [Ann Lib Sci Doc]	14(1)
ASLIB Proceedings [Aslib Proc]	19(5)
Bookmark	26(5,6,7,8,9)
British Printer [Brit Print]	80(2,4,5)
College and Research Libraries [Coll Res Libs]	28(1)
Data Processing [Data Processing Lond]	9(3)
IASLIC Bulletin [Iaslic Bull]	12(2)
Journal of Education for Librarianship [J Educ Librnship]	7(3)
Journal of Library History [J Lib Hist]	32(2)
Library Association Record [Lib Ass Rec]	69(5,7)
Library Journal [Lib J]	92(5,6,7,8,9,10,11,12)
Library Quarterly [Lib Quart]	37(1,2)
Library Resources and Technical Services [Lib Resources Tech Serv]	11(2)
Library Science with a slant to Documentation [Lib Sci Slant Doc]	4(2)
Library Trends [Lib Trends]	15(3,4)
Libri	17(1)
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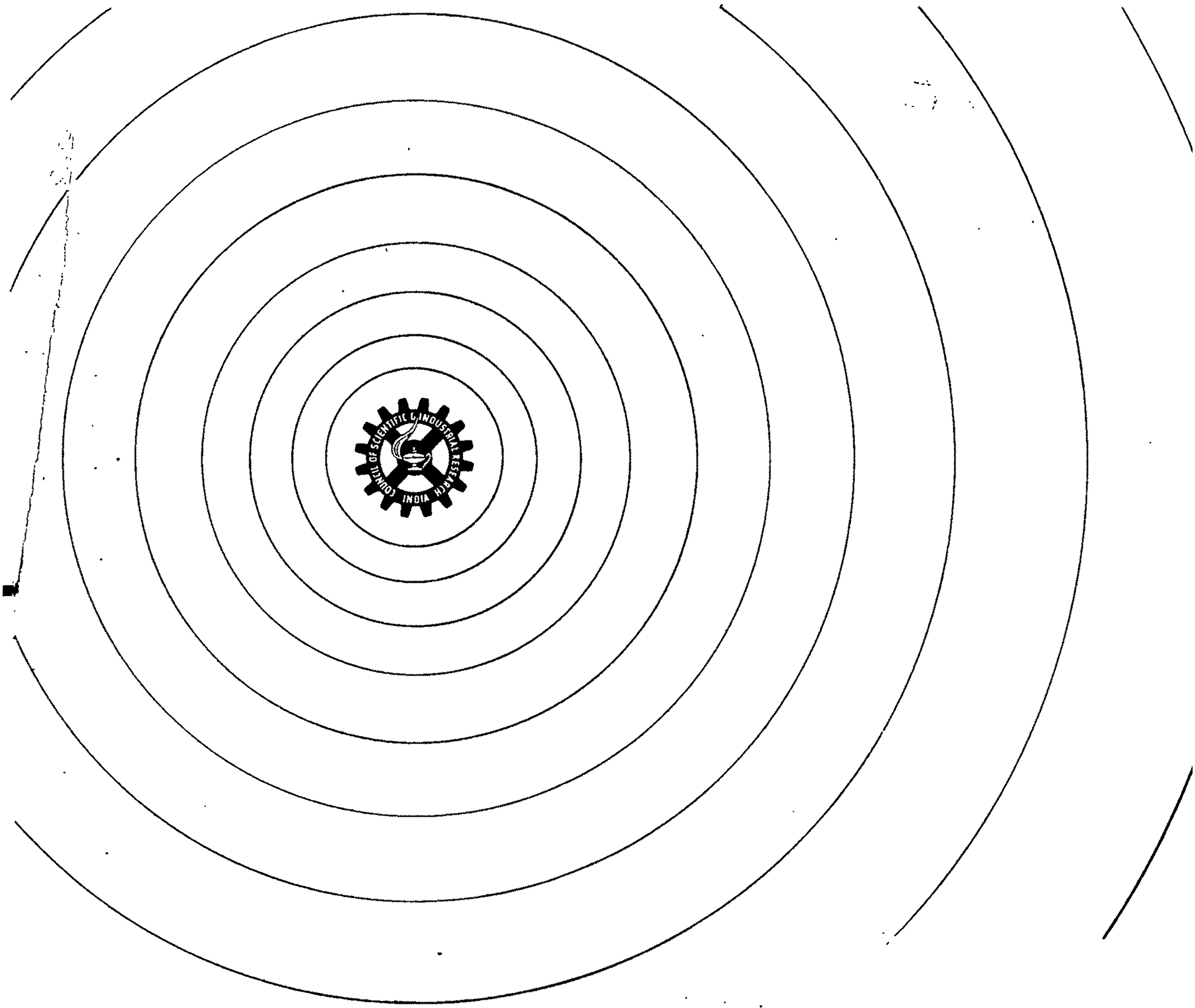

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THE ROLE OF A MACHINE IN SCIENTIFIC AND TECHNICAL INFORMATION*

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It is stressed that successful application of machines in the field of information retrieval will depend to a large extent on the development of a sound theory of scientific information or Informatics. This involves fundamental investigations in the fields of linguistics, psychology, mathematical logic, semantics, semiotics, etc.

Recent years have been characterized by intensified activities in the field of scientific and technical information in many countries the world over.

Extensive theoretical and experimental investigations into processing scientific information have been developed. This is confirmed by an enormous number of publications reflecting the development of the scientific thought in the field of information activities, by a great number of international, regional, national scientific meetings, symposia, conferences, etc. The main line of these studies and scientific communications is a search for ways of speeding up the information activity processes.

Despite successes reached in the field of scientific investigations and design developments, in our days the necessity has become obvious of critical evaluation of obtained results in the field of evolvement of scientific foundations and new engineering devices both from a viewpoint of satisfying demands of information users and from a viewpoint of complex solution of the entire information problem.

We agree with the opinion of the American investigator Ben-Ami Lipetz who wrote last year in the September issue of the "Scientific American" journal devoted to utilization of computing machines: "Exceptional progress has been made in providing high-speed access to carefully defined and limited stores of records. With progress, however, has come the realization that the ultimate goal is far more difficult to achieve than had been thought earlier. It involves not only the development of techniques for storing and manipulating records but also the improvement of our understanding and simulation of the ways in which people make associations and value judgments, together with the development of more reliable methods of predicting human information needs. The problem is largely an intellectual one not simply one of developing faster and less expensive machinery"[1].

Our investigations in the past were directed in the main to solution of individual, specific problems. At present, however, more and more attention is devoted to problems of development of a theory of scientific information activity.

So far we do not have an acceptable name for a scientific discipline investigating the structure and properties of scientific information, as well as regular features of information activity, its theory, history, methods and organization. The term "theory of scientific information" used at present is obviously narrow and inconvenient. In my opinion, the most appropriate term will be "informatics". Such a suggestion is substantiated in an article published in the journal "Scientific and Technical Information", No. 12, 1966. Subsequently I shall use this term. We maintain that the aim of informatics is to study regularities and to evolve optimal methods and facilities of collection, analytical and synthetic processing, storage, retrieval and dissemination of scientific information.

**Paper presented at the 33rd FID Conference, Tokyo, 1967. Reprinted by the kind courtesy of Professor A I Mikhailov.*

Much has been done already in informatics in order that modern technical facilities, in particular electronic digital computers, can occupy a prominent place in scientific information activity. However, the role of a machine in informatics sometimes is understood in a too simplified manner, and in investigations and experiments in which use is made of computers not all lines of research have been developed to a sufficient degree.

Informatics as independent field of science has been formed not only as a result of an exponential increase in the amount of scientific and technological literature but also as a result of peculiarities in the development of scientific and engineering progress. Modern science and technology is characterized by two typical trends.

1. The ever increasing complexity of scientific and engineering problems,the solution of which is feasible only by large teams of scientists and engineers of diverse specialities. These teams need adequate information service which assumes the ever increasing mass character. The effective solution of this problem requires the use of means of mechanization and automation.

2. A rapid decrease in the time of development, assimilation and introduction of various discoveries and inventions. Academician Keldysh, President of the USSR Academy of Sciences, points out in his article "Natural Sciences and Their Significance for Development of World Outlook and Technological Progress" ("Kommunist", 1966, No.17): "The statement to the effect that the age of science and technology is precisely our time is not quite correct. In all times the material and technological progress has been based, to a considerable degree, on the development of science. The roots of the industrial revolution also lay in science. The past century was characterized by a very large amount of great scientific achievements. It is erroneous to believe that earlier there were few discoveries in the field of natural sciences which resulted in great consequences in the field of material production, that it is only now that we have entered the age of continuous descoveries.

However, there is one feature very typical of modern development of science and technology, namely, rapidity of practical utilization of scientific discoveries. A number of examples may be cited. From the moment of discovery of electric current (Galvani) to establishment of the first electric power station nearly a century has elapsed. It has taken almost one hundred years to assimilate this splendid discovery of enormous prospects. It may be also remembered that from elucidation of the role of mineral fertilizers in plant feeding (the middle of the past century) to their intense use, nearly seventy years have elapsed. But their really extensive use began only after World War II. The situation was different with the discovery of uranium nuclear fission. From the moment of this discovery to creation of the first nuclear reactor only three years have elapsed and to commissioning of the first atomic power station 15 years.

Due to the fact that our time is characterized by extremely fast utilization of scientific achievements, good organization of scientific research and of use of their results in production is acquiring the ever increasing importance. Today in realization of a production process not a country which was first in making a new scientific discovery may be ahead, but a country which will be able to better organize its fastest use in practice".

This peculiarity may be illustrated by some other examples. From the moment of discoveries which finally brought about the emergence of photography at the first half of the eighteen century and to the introduction of photographic facilities into practice 112 years have passed. It has taken 56 years for development of facilities of telephone communication, 35 years for radio, 15 years for radar, 12 years for television and only five years for transistors.

Such acceleration in the tempos of research and development requires an adequate high-speed increase of information systems. Obviously this problem can be solved only through extensive use of mechanization and automation facilities in information.

Consequently modern organization of information service should not only help the investigator in orienting to rapidly growing collections of scientific data, but satisfy users' needs proceeding from many aspects of development of the scientific thought.

The history of development of informatics can provide us with many examples of futility of solving a scientific information problem through creating complex machines simulating some information processes. To get convinced in it one should look back at the past. Let us recall the unrealizable hopes connected with creation of such information-retrieval systems as Rapid Selector, File-search, Minicard, etc. In 1958 we attended an American exhibition sponsored by the FID conference in the USA where a wide range of perfect machines were exhibited which later did not find wide application in information service. At the same time the work on such facilities was useful at least in two respects. It made it possible to realize that the main difficulties of mechanization and automation of information processes consist not in the absence of necessary technological means but in the fact that inner processes of execution of such processes by man are unexplored. And when the inner mechanism of execution of this or that operation by man is not clear, we can only imitate this process but are unable to simulate it.

Another useful result of the work connected with the development of information-retrieval facilities was accumulation of valuable experience which finds ever wider application along various lines of information service.

Discussing the role of machines in information activity let us recall the evolution of views of specialists on machine automatic translation. If in early fifties many investigators easily promised to replace a man-translator by a machine literally in a few years, later their ungrounded optimism gave place to sober understanding of the extreme difficulty of the problem facing them. Now hardly any serious investigator will state that a machine translation problem (in its strict sense) can be solved in two or three years to come.

Here the difficulty also lies not in imperfection of a machine but in the necessity of conducting profound theoretical investigations. I would like to refer to the idea of a Soviet linguist I.A. Melchuk from his critical and bibliographic handbook "Automatic Translation" just published by the Soviet Institute of Scientific and Technical Information (VINITI) "The rules or algorithms of automatic translation should be devised without any reference to engineering capacities of machines. It is only necessary to ensure principle realizability of these rules on a machine, i.e. to formulate them rigorously, unambiguously and to comprehensively list all data used" (p. 8).

Our interests in problems of machine translation is determined not only by the fact that translation of scientific and engineering texts from one language into another occupies a prominent place in scientific information activity. Of far more importance is the fact that effective use of a machine in this work requires a solution of problems of automatic abstracting and indexing, and these problems are related with automatic translation.

It should be pointed out that many investigations of these problems are performed in a purely practical, applied aspect. For instance, automatic abstracting is carried out on the basis of selecting some phrases reflecting to more or less extent the content of an abstracted document. The late H. P. Lunn was the pioneer of this technique. Since a set of phrases obtained by such methods is not, strictly speaking, an abstract, it would be more appropriate in the given case to speak about automatic quasiabstracting. In the same way attempts are being made for automatic indexing not by a full text of a primary document but by its abstract or even title in which the main idea of the document is already expressed by man (the author of the abstract or the document itself).

By scientific aspect of this problem we understand implementation of automatic abstracting and indexing in the full sense of these terms. This means that the unprepared text of a scientific document - a book, an article, a patent, etc., is abstracted. The procedures of automatic abstracting may be as follows:

a) translation of the text of a document into a formalized language;

b) the revealing of the main subject matter of this document and expression of the given subject in a formalized language;

c) translation of an abstract from formalized language into a natural language.

If the problem of automatic abstracting is solved (the detection of the main subject matter of a scientific document is here the most important and difficult task), then automatic indexing becomes practically realizable. For this purpose it is sufficient to translate an abstract from a formalized language to another formalized language used in the information-retrieval system.

The solution of this circle of problems is possible only after profound fundamental investigations have been made in many branches of science - linguistics, psychology, mathematical logic, semantics, semiotics, etc. These investigations should disclose the mystery of human thinking which is of general scientific interest. Such investigations are so complex that hardly any essential results may be expected in the near future. Nevertheless, investigations should undoubtedly be expanded and deepened.

Attention should be drawn to the fact that without solving a machine translation problem it is impossible to solve a problem of automatic abstracting and indexing. To fulfil this essential problem all methods are appropriate and important, including automatic quasiabstracting in all its varieties and automatic indexing of abstracts of scientific documents. Of course, here such factors should be primarily taken into account, as comparative cost of processing the texts, gain in time obtained, etc. It should be emphasized that development and practical implementation of the above methods in no way means a solution of a problem of automatic abstracting and indexing in its rigorous scientific sense.

To sum up, the problem under consideration has two aspects — a scientific one and a practical one. Both these aspects are important but it is impossible to take achievements in solving a practical aspect of this problem for solution of its scientific aspect. A clear understanding of this difference is the necessary condition of success of our further work in this important direction.

In this connection, of paramount importance is to solve a problem of automatic reading of texts. Without automatic reading devices any practical system of automatic abstracting and indexing cannot be implemented and investigations in this field are impossible on a sufficiently large scale. It should be borne in mind that all suggestions of using punched tape obtained in flexowriters, monotypes, etc. for feeding in a machine, as well as other similar suggestions have nothing to do with the problem of automatic reading of texts, although they are quite useful in a practical respect.

Semiotics undoubtedly belongs to important lines of scientific investigations which should be developed for solving the problems of informatics. Creation of artificial formalized languages of science and technology, as well as languages of generalized programming is one of the most significant conditions of automation of information work. The solution of central problems of structural linguistics, machine translation and deciphering of old written languages will considerably help us in solving the problem of automatic analysis of the context of scientific documents.

In this connection I would like to note the following. It is supposed that results of semiotic investigations will find practical use in information activity in the future when the main problems of automatic analysis of the text will be solved. However, we cannot wait for this time. That is why it is an absolute necessity that specialists in semiotics already now take an active part in some concrete studies into designing information-retrieval systems, in studies into information requirements of users, in improving methods of document processing, in ordering of information flows. This will unite our efforts in solving urgent problems of informatics and will make investigations of semiotics more purposeful.

In connection with wide application of machinery one more important field of informatics has appeared. I mean studies in a system of scientific publications. Up till now the opinion has prevailed that the information crisis has appeared in connection with great increase in scientific publications. Authoritative scientists have time and again pointed to the necessity of limiting and ordering of publishing scientific literature. As an example J. D. Bernal's well known project may be cited which suggests replacement of the modern system of scientific journals and similar suggestions to this effect. However, investigations now being conducted in many countries clearly show that we know very little the inner regularities characterizing the scientific publication system. Being the chief means of transferring scientific data in time and in space, scientific documents are governed by some objective regularities, without which it is impossible to correctly plan information activity or improve the system of publications.

Long ago attempts have already been made to study this problem on the basis of registration of cited literature, establishing correlations between documents formed through bibliographic references. However, only after this technique has been made effective owing to computerization, it has started yielding essential results.

The aim of my communication is to show the role of a machine in information activity. It goes without saying that the path to acceleration of all information processes can be made only by an automatic machine in combination with intellectual work of man necessary in all cases. Requirements formed for such machinery should be scientifically substantiated. We face two great independent problems correlated with each other in an inner way.

The first problem is centralized processing of literature on science and engineering. Conditionally this problem can be represented as an information system at whose input there is a flow of world literature. After processing, at the output of this conditional system we have bibliographic signal information, series of abstracting journals with a system of various indices. Here a computer's role is quite obvious. The creation of automatic input of a printed text remains an acute problem. Of great importance are high-capacity reproducing instruments for type-setting printing and printing without type-setting. However, clearness in these individual problems does not remove the necessity of a wide front of investigations mentioned at the beginning of the presented paper.

A whole group of complex problems connected with the creation of information-retrieval systems may be referred to the second problem. Here great is the role of a digital computer as a means of helping to conduct experimental retrieval on a large scale and in shorter periods of time. Over the recent years in the Soviet Union some experimental retrieval systems have been designed. All of them are built on different principles, i.e. they are fragmentary.

Can it be considered that today all these studies illumine the whole problem? Of course not. But these investigations accumulate very interesting facts which cannot be overestimated. The sum of these facts will help us to approach in a proper way to the creation of a centralized or coordinated information-retrieval system. In the USSR this problem is being solved on a state scale. We have started the organization of a single system of scientific and technical information.

In conclusion I would like to emphasize once more an acute necessity of developing extensive theoretical and experimental investigations into cardinal problems of informatics.

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KEYWORD INDEXING FOR THE INDIAN SCIENCE ABSTRACTS

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Describes the origin, growth, development and utility of keyword indexing. Discusses variations to KWIC and conducts a brief survey of computer-based keyword indexing as used by various indexing and abstracting services. The main features and principles of keyword index of ISA are also outlined.

INTRODUCTION

The keyword index has been defined as a listing, usually of document titles, with the significant words arranged in alphabetic order in a column. A keyword without context does not adequately clarify the scope and contents of the subject, and as the same keyword may occur in different subjects, it is made explicit by using the context. Thus a keyword has its significance and limitation well defined when viewed against a particular context.

From its inception in January 1965, keyword indexing has been adopted in a modified form in the Indian Science Abstracts (ISA) to serve as an alphabetical subject index to its contents. The system followed is keyword with context, and the same pattern has been followed with some modifications in the machine made index introduced from July 1966 issue. These modifications have been described later.

The index entries are prepared manually as before; but they are now punched on IBM 80-column punch cards and processed through a digital computer (IBM 1620). The processing consists of only alphabetizing the entries and printing them in 70 character index line.

The computer has been brought into action to save time and manhour of work in preparing the printed index. Moreover, as all punched cards for monthly index entries are stored for future use, cumulative indexes can be compiled from them rapidly and economically. The comparative economy effected by computer over manual processing with respect to cost, time and manpower is beyond the scope of the present paper which only aims at discussing the points as laid out in the abstract.

PERMUTATED INDEX: ORIGIN AND GROWTH

The concept of keyword indexing in the form of scholarly concordances existed for centuries. More than a hundred years ago, the same concept was used for permutated indexing (i.e. A. Crestadero's Art of making catalogues of libraries, 1856) in England [3], and also for 'catchword' indexing for cataloguing in Germany.

H. P. Luhn, the pioneer in the field of mechanised permutated indexing, introduced the machine based index in 1959. He had also later advanced the idea of selective dissemination of information (S.D.I.). About the same time, Citron, Hart, and Ohlman were engaged in developing the same type of index.

Considering its recent origin, the concept has undergone rapid development and found practical use. It is being increasingly used by various abstracting and indexing services, commercial and industrial establishments, government agencies, institutions etc. As it is not possible to describe all such indexing periodicals and the systems used by them, only a few variations to the original code (i.e.Keyword -in-index or KWIC as developed by H. P. Luhn) will be discussed.

MECHANISED KEYWORD INDEXING

KWIC is a machine generated permutated index, based on title citations. This presupposes that the title is constituted of significant words to make it meaningful which, in reality, is not always the case. After the title is key-punched, the machine-readable record in the form of punched cards serves as input to the computer. The machine selects keywords either by using a thesaurus of keywords, which has been transferred to its memory or the machine memory is programmed by a stoplist to ignore 'common' words. The latter method is more practical although some words of doubtful significance may get admitted, which can, of course, be eliminated at a later stage or tolerated as 'noise' [4]. Some arrangement of vocabulary management may be necessary to insert human-selected keywords to citations to supplement the deficient ones. The computer prints one index entry for each keyword serving as entryword. Thereafter, these index entries are alphabetically arranged by,their respective keywords and reproduced.

KWIC CONCEPT

The keywords can be taken from title, abstract or whole text, along with words in its vicinity, and made to retain a fixed position within them. The keywords are arranged alphabetically, the modifiers retaining their original sequence and consequently the keywords, being sorrounded by words in its proximity, can be read in context. The KWIC index, thus generated, presents a 'wrap-around' or 'recirculated' appearence. The form of KWIC index, as now used by some indexing services i.e. B.A.S.I.C., Bioresearch Index (supersedes Bioresearch Titles which ceased with December 1966), and Chemical Titles are shown (Annexure 1 to 3). Chemical Abstracts uses Keyword-without-context (Annexure 4).

VARIATIONS TO KWIC

At present, there exist several variations of KWIC i.e. KWOC, KWAC, KWIT, WADEX etc. The very fact that the KWIC concept can be made to undergo variations in form to suit individual needs shows the flexibility of the system and the ease with which it can be manipulated.

KEYWORD-OUT-OF-CONTEXT (KWOC)

KWOC is used by Keyword Titles (Pub: Office of Technical Services), Scientific and Technical Aerospace Reports (Pub: National Space Aeronautics and Space Association) and International Aerospace Abstracts (Pub: American Institute of Aeronautics and Astronautics etc.) [3].

In this system, the keyword is taken out of the context and placed outside it and the title is repeated again.

Example:
Title: Spin-waves in impure ferromagnetics.
Index entries:

FERROMAGNETICS:	SPIN-WAVES IN IMPURE FERRO-MAGNETICS
SPIN-WAVES:	SPIN-WAVES IN IMPURE FERRO-MAGNETICS

There are several variations to this form of index (KWOC) also.

WORD & AUTHOR INDEX (WADEX)

This form of permutation indexing combines subject and author entries using the author's names as keywords. Thus, machine indexing also offers the facility of searching a document through author's name.

It does not seem to be necessary here to elaborate further on other variations of KWIC or KWOC index.

ROLE OF THESAURUS

A thesaurus, when used for information retrieval, has been described by Balz as:

"A collection of authorized subject headings or 'descriptors'. These descriptors are arranged according to conceptual groups and fields, accompanied by an alphabetic index and containing pertinent scope notes and cross references".

Synonyms and homonyms, which originate due to use of natural language, can be correlated through cross reference entries with the help of a thesaurus. It will also help to select keywords and appropriate search terms by avoiding word ambiguities, difference in spellings etc., besides synchronising the entire process of indexing and information retrieval. A thesaurus is, no doubt, necessary but there is little evidence to show that it has found favour with KWIC indexing.

ISA INDEX

The indexing pattern of ISA has grown out of the needs peculiar to it which aims at abstracting the literature covering all aspects of science and technology.

The system of keyword indexing, as used in ISA, is a marked departure from those that are now being used by the present day indexing services. It is a modified form of KWOC.

The modifications consist of using qualifier(s), whenever possible, along with keywords which are placed outside the context and not repeated within it. This variation of KWOC considerably reduces the length of an index entry without markedly reducing its effectiveness.

DISSEMINATION AND RETRIEVAL INDEX

The machine generated keyword index can process enormous quantity of material with least effort within minimum possible time for immediate communication to public. Thereby, it serves the purpose of current awareness service in the form of an index. But the 'recirculated' look is not conducive to easy reading and since the number of characters per entry are limited, words are sometimes broken up or split at the end of a column. Some titles are ambiguous or misleading which, in turn, generate imperfect index entries. Moreover, many 'unsought' terms creep in as keywords due to mechanical system in auto-indexing. They swell the index without any advantage for information retrieval. These disadvantages can, however, be tolerated because they generally serve as dissemination index and is transitory in nature.

However, for those services who want a carefully prepared index for its ultimate use as a permanent tool of reference (i.e. retrieval index), title management by editing becomes necessary and thus the human factor is inevitably brought in the picture. Since auto-indexing cannot match manual indexing in efficacy, the latter is preferred in ISA for generating the index. Processing of the index entries is done by the machine. Men and machine, thus, work in close co-operation to produce the keyword index of ISA.

MAIN FEATURES

A logical code of practice for preparing ISA index has been evolved in order that the pattern of indexing will not vary if different indexers take over at different times. As complete enumeration of the code will increase bulk of this paper, only its salient features and principles will be described:

Structure and Form:

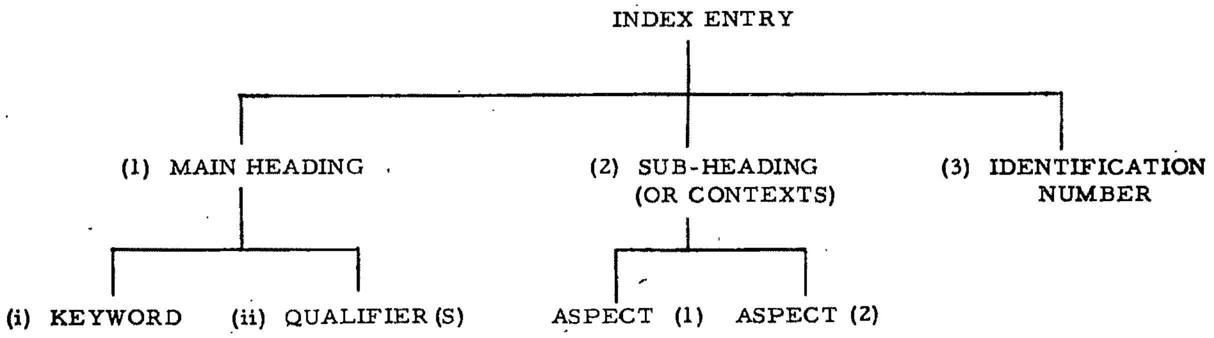
Generally, an index entry of ISA index consists of (1) main heading, (2) sub-heading or context(s), and (3) identification number.

The main heading, in turn, consists of (i) keyword, and (ii) qualifier(s).

The sub-heading, which is placed below the main heading, will, hereafter, be termed as context(s). It consists of one or more aspects separated from one another by a bar (-).

An index entry may, however, also consist of a single keyword with or without any of the subsequent constitutents.

It can be illustrated by the following schematic representation:



(1) Main heading

The main heading consists of a noun (or a phrase), or a noun qualified by one or two adjectives which are termed as qualifier(s).

Normally an inverted form is used so that the adjectives follw the noun. A comma (,) is interposed between the noun and the adjective, e.g. CELL CARCINOMA is entered as CARCINOMA, CELL.

When a term (e.g. GIANT) is used to qualify a keyword in addition to another adjective qualifier (e.g. CELL), the 'GIANT' qualification is to be regarded as subordinate and be placed immediately after the keyword, for example,

GIANT CELL CARCINOMA is entered as
CARCINOMA, GIANT CELL.

But, where common usage demands, the uninverted form is used, e.g. SEA SICKNESS, CENTRAL NERVOUS SYSTEM etc.

The constituent parts of an index can, therefore, be briefly indicated as follows:

1. (i) Keyword:

It is the catchword or the essential word which covers an important aspect of the subject under review. The policy is to enter the information not to the generic but to the most specific level. In ISA index, selection of keywords is made from the title, abstract and whole text, whenever feasible. Usually the singular form of the catchword is used because it is felt that while searching, people generally think in singular form. But the nouns (or keywords) which have no singulars are used as such i.e. anaesthetics, forceps etc. Abbreviated terms, and words beginning with numerals or Greek letters are generally not used as keywords.

(ii) Qualifier(s):

It is a word or group of words (generally adjectives or adverbs) which qualifies the keywords and is separated from it by a comma (,).

Example: FLOW, UNSTEADY/IN
VISCOUS FLUID

The word 'unsteady' is the qualifier here.

2. Context(s):

It is a brief description of the subject in addition to the keyword. The context is made as brief as possible by using only essential rds, abbreviated terms, minimising conjunctions and eliminating articles, whenever possible. It is separated from main heading by placing it below.

Sometimes it becomes necessary to add a secondary aspect to the primary one. Such cases occur when the primary aspect does not fully clarify the scope of the subject and then the secondary aspect is used in its continuation and separated from the former by a bar (-) to carry the idea beyond to make it meaningful.

Example:
Heat transfer to fluids flowing through an annular passage.

Index entry:

FLUID FLOW
THROUGH ANNULAR PASSAGE
HEAT TRANSFER TO.

SPECIAL FEATURES

As the machine has no lower case types, subscript or superscript numerals, chemical symbols, names of elements, radicals and compounds (excluding selected abbreviations) and Greek letters are spelled out in full. The citation of an element is followed by isotope mass numbers or indications of valence in Roman numbers which are separated from it by a bar (-), as in uranium-238.

Inorganic compounds are not entered under their formulae when used as keywords, but the practice differs in sub-heading. Chemical formulae with subscripts are spelled out in full in any part of an index entry whereas those without them are entered under their chemical formulae in context(s).

For complex organic compounds, positional and isomeric designations are not shown while their parent structural units are used as keywords, followed by the term 'deriv'.

Example:

(1) 2, 4-Dimethoxy-6-sulphanilamide-1, 3 diazine.

Entered as:

SULPHANILAMIDE DIAZINE DERIV

(2) 5-10-Dimethyl Keto octanhydroazulene (3, 4,5,6,7,8,9,10-)

Entered as:

OCTANHYDROAZULENE DERIV

Besides, nomenclature and form of chemical compounds as entered in ISA index generally follows the same pattern as in the Chemical Abstracts.

EXAMPLE FROM ISA

A concrete example, as enumerated below, will illustrate the procedure of preparing index entries for the respective keywords as contained in the title and abstract of the following document which appears in the Indian Science Abstracts 1956, 2(11), 1271:

10887

SHUKLA J P, NIGAM A K (NSI, Kanpur): Bacterial contamination in Indian distilleries using waste molasses as raw material. Proc a Conv Sug Technol Ass India 1965, 33(1), 77-9.

Yeast and bacteria were isolated from a distillery main fermentation vat. Desired ratios of bacteria and Saccharamyces cerevisicae N.S.I. 13 C strain of yeast were inoculated to the sterilised molasses, of 17.5 Brix and fermented for 72 hr. at 35°. Bacterial contamination reduced the alcohol production. At about 90:10 cell mass ratio of yeast to bacteria, the alcohol yields showed rapid reduction. Under these conditions the fermentation reaches a stabilised state under distillery conditions. (BK)

KEYWORD INDEX

ALCOHOL FERMENTATION
    BACTERIAL CONTAMINATION
        EFFECT ON 10887

DISTILLARY
    BACTERIAL CONTAMINATION
        EFFECT ON ALCOHOL
        FERMENTATION 10887

MOLASSES
    BACTERIAL CONTAMINATION
        EFFECT ON ALCOHOL
        FERMENTATION FROM 10887

SACCHARAMYCES CEREVISICAE
    BACTERIAL CONTAMINATION
        EFFECT ON ALCOHOL
        FERMENTATION BY 10887

YEAST
    BACTERIAL CONTAMINATION
        EFFECT ON ALCOHOL
        FERMENTATION BY 10887

A specimen page containing index entries of ISA has also been appended at the end (Annexure 5).

IDENTIFICATION CODE

In Chemical Titles, entries in the Bibliography section are arranged according to initial alphabets of their alphanumeric code numbers and they, in turn, are correlated to KWIC index by these numbers. As the index entries of ISA are arranged alphabetically according to keywords, they are linked to the abstracts by the serial numbers of the latter.

CROSS REFERENCES

In the index of each issue of ISA, index entries are entered under keywords and their variants, wherever they occur, but they are not correlated through cross reference entries. The information supplied by ISA is generally suited to needs of researchers. They are supposed to be familiar with both technical and commonly used terms concerning their subject fields. Since all index entries commence with 'sought' terms as keywords, they are expected to locate information through any term that they may be familiar with. For example, entries are made both under carcinoma and cancer, or ascorbic acid and vitamin C as they occur in the citation or abstract. The terms are not selected from thesauri because firstly, thesauri of all such subjects as covered by ISA are not available; and secondly, if every term is tested with thesauri prior to its selection, then work at the input stage will be considerably slowed down.

It is, however, contemplated to provide cross reference entries between synonyms and homonyms in Annual Cumulative Indexes of ISA; but no attempt will be made therein to establish correlation between botanical and zoological or common names of plants, animals etc.

CONCLUSION

From the foregoing discussion, it can be concluded that when volume of information under process is not very large and accuracy has to be combined with speed, manual keyword indexing coupled with machine processing will accelerate dissemination of information. The index, thus prepared and cumulated will subsequently serve as a medium for information retrieval, if suitable cross-references are interpolated.

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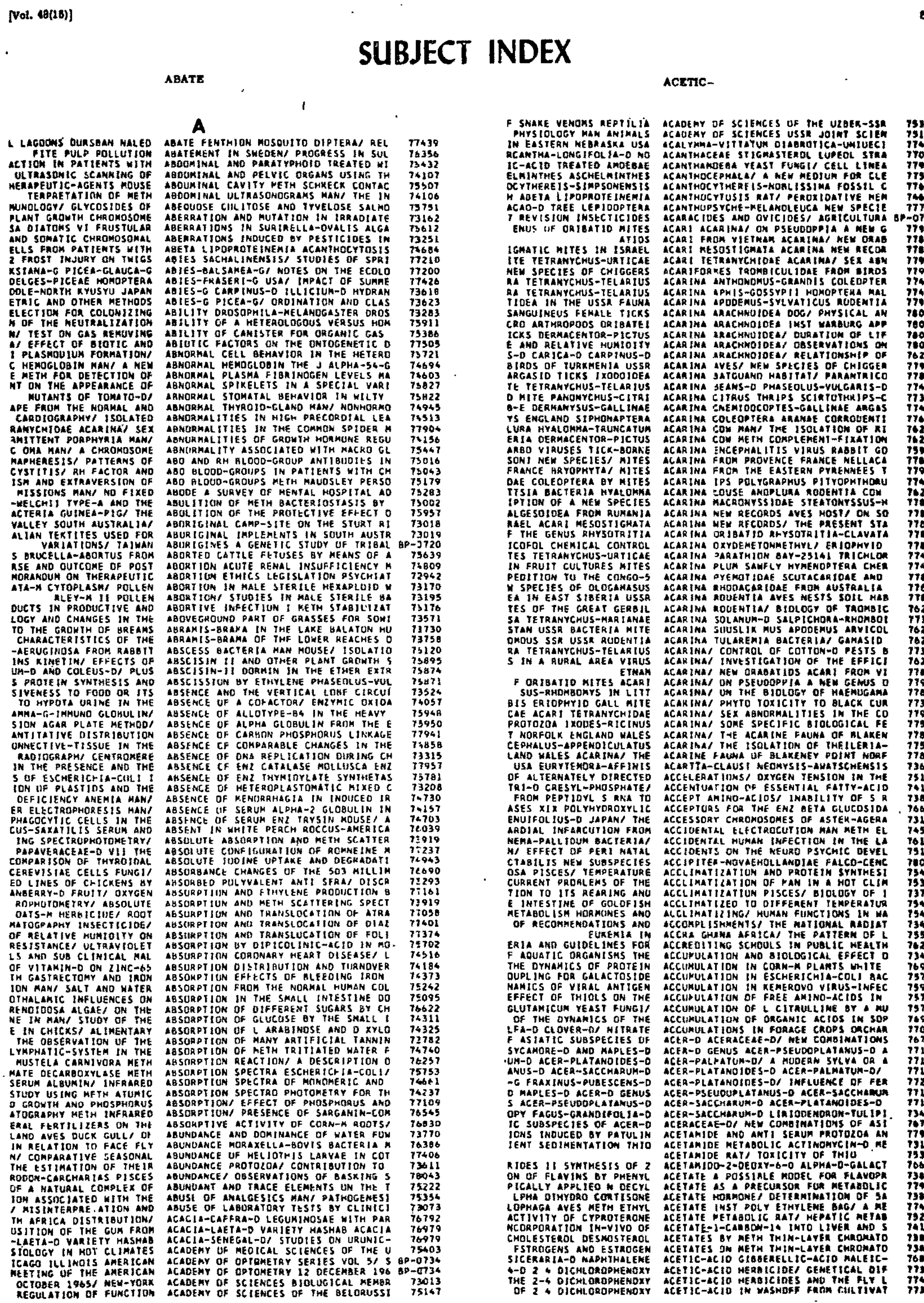

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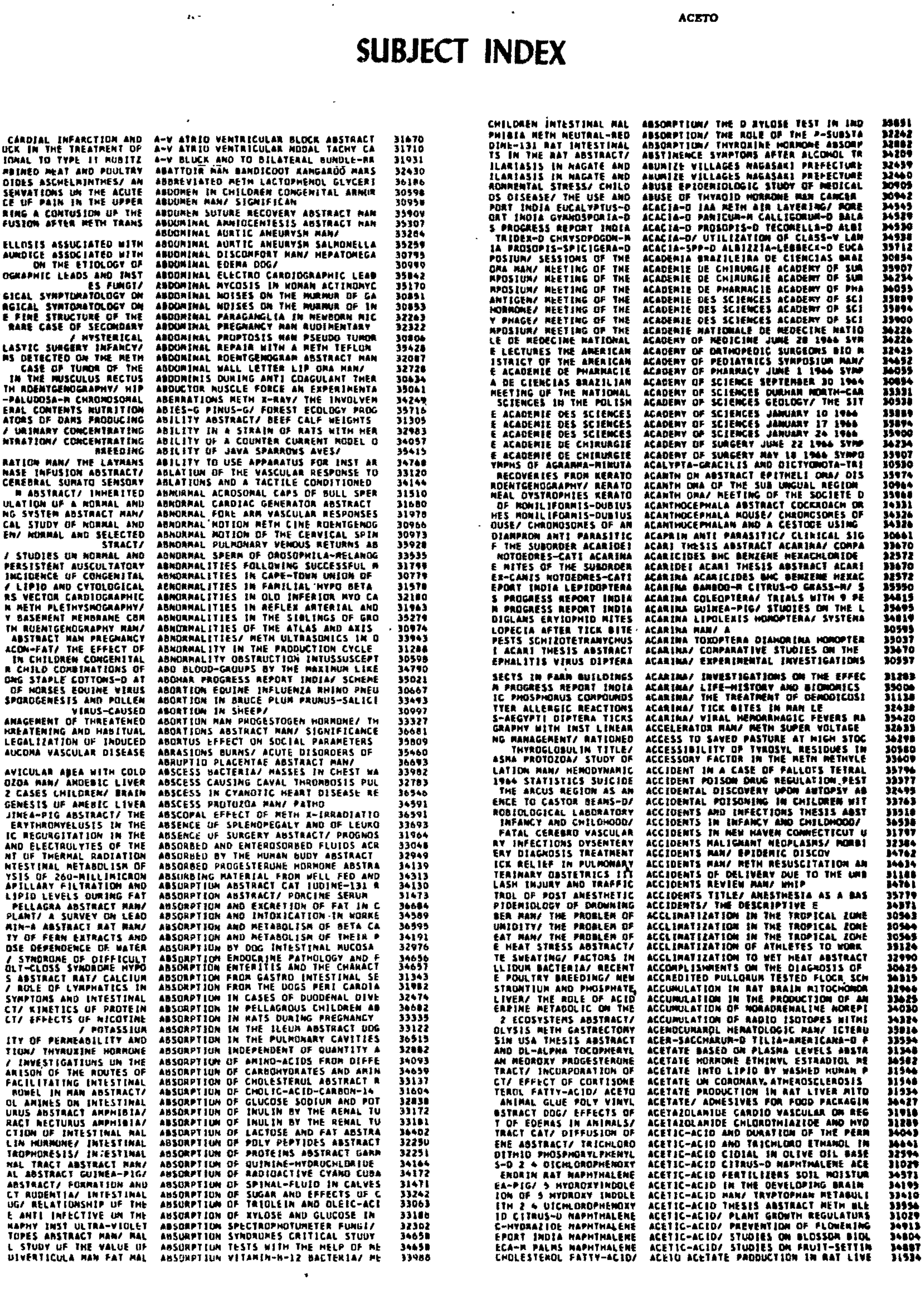

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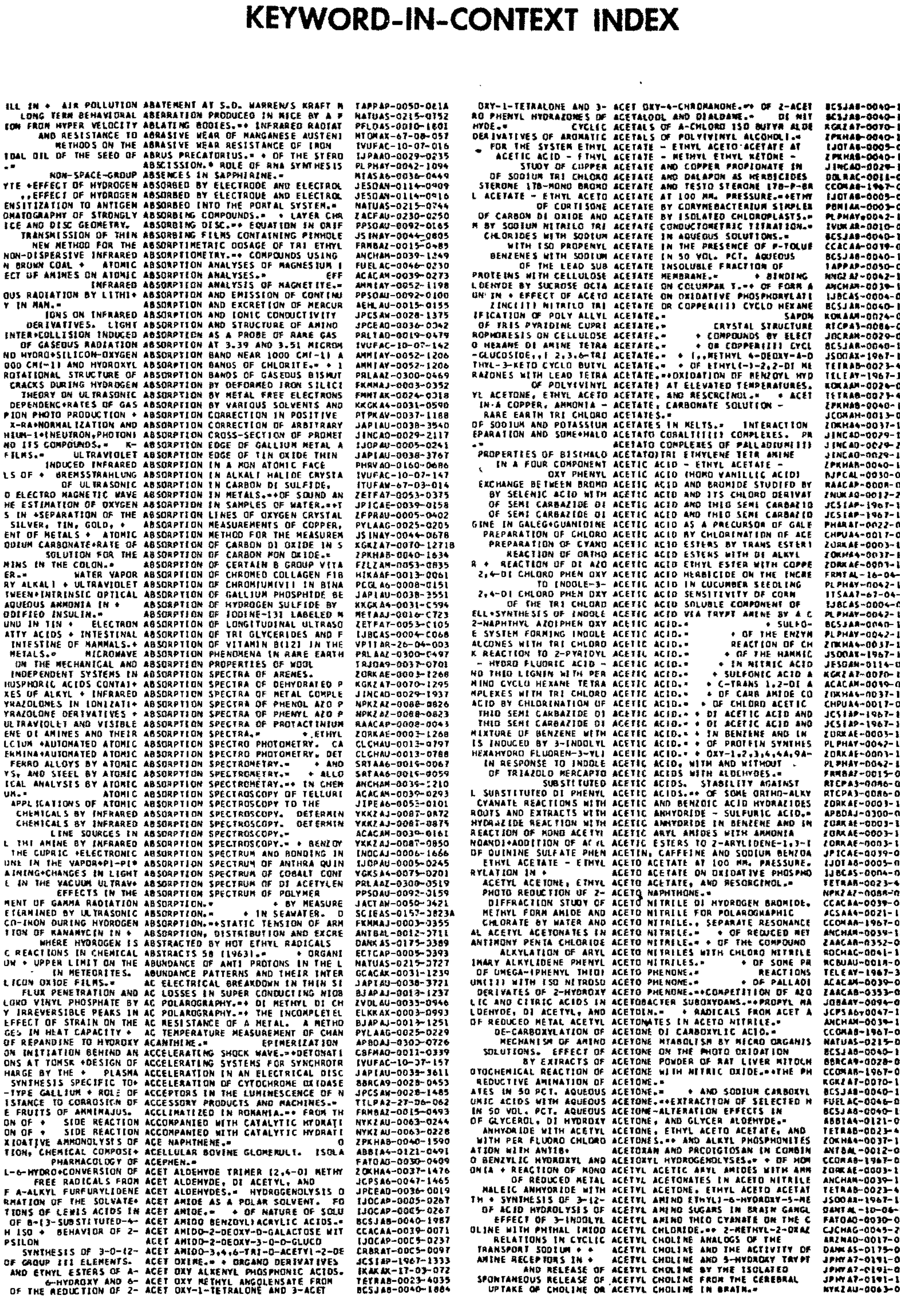

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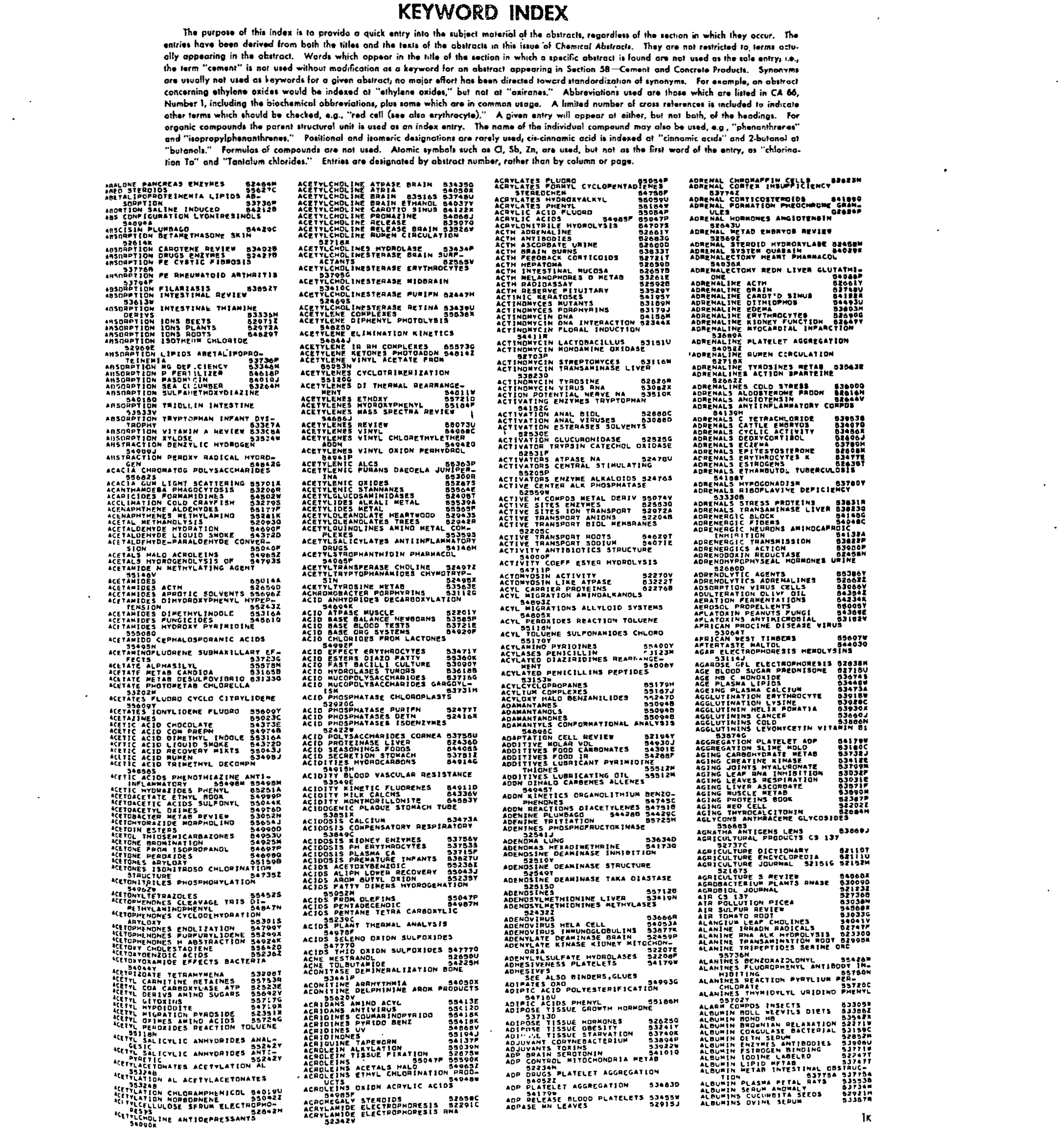

KEYWORD INDEX

The purpose of this index is to provide a quick entry into the subject material of the abstracts, regardless of the section in which they occur. The entries have been derived from both the titles and the texts of the abstracts in this issue of *Chemical Abstracts*. They are not restricted to terms actually appearing in the abstract. Words which appear in the title of the section in which a specific abstract is found are not used as the sole entry; i.e., the term "cement" is not used without modification as a keyword for an abstract appearing in Section 58—Cement and Concrete Products. Synonyms are usually not used as keywords for a given abstract; no major effort has been directed toward standardization of synonyms. For example, an abstract concerning ethylene oxides would be indexed at "ethylene oxides," but not at "oxiranes." Abbreviations used are those which are listed in CA 66, Number 1, including the biochemical abbreviations, plus some which are in common usage. A limited number of cross references is included to indicate other terms which should be checked, e.g., "red cell (see also erythrocyte)." A given entry will appear at either, but not both, of the headings. For organic compounds the parent structural unit is used as an index entry. The name of the individual compound may also be used, e.g., "phenanthrenes" and "isopropylphenanthrenes." Positional and isomeric designations are rarely used; cis-cinnamic acid is indexed at "cinnamic acids" and 2-butanol at "butanols." Formulas of compounds are not used. Atomic symbols such as Cl, Sb, Zn, are used, but not as the first word of the entry, as "chlorination Ta" and "Tantalum chlorides." Entries are designated by abstract number, rather than by column or page.

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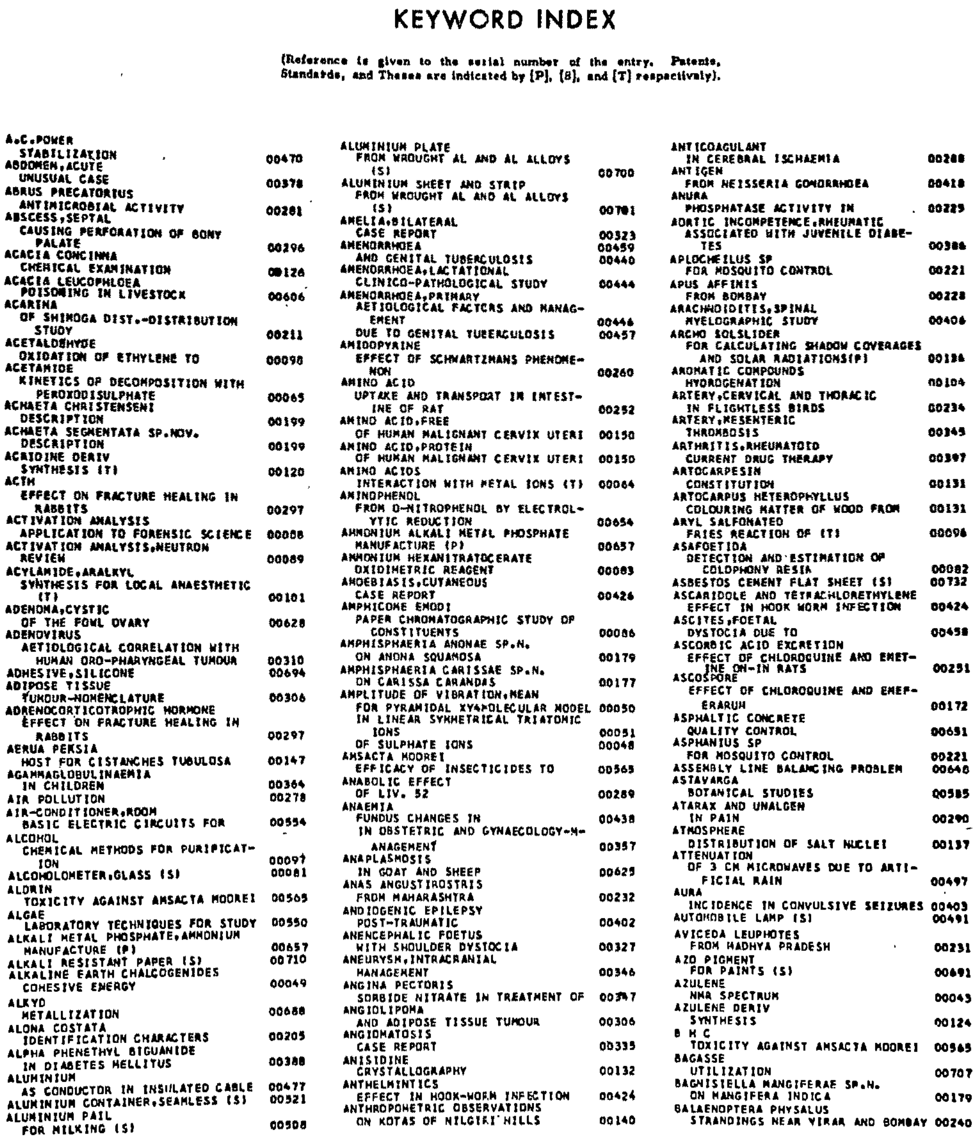
Annexure 4. A sample page from the Chemical Abstracts



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TOXICITY AGAINST AMSACTA MOOREI	00565
BAGASSE	
UTILIZATION	00707
BAGNISIELLA MANGIFERAE SP.N.	
ON MANGIFERA INDICA	00179
BALAENOPTERA PHYSALUS	
STRANDINGS NEAR VIRAR AND BOMBAY	00240

Annexure 5. A sample page from the Indian Science Abstracts

LITERATURE SEARCHING WITH THE SCIENCE CITATION INDEX: AN EXPERIMENTAL STUDY*

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The retrieval efficiency of the 'Science Citation Index' is tested in respect of the Indian references on a very specific area of bio-medical research, namely 'Haemorrhagic Fevers'. The procedure followed, results obtained and conclusions drawn thereupon are presented.

1 SCIENCE CITATION INDEX

Of the several citation indexes, "probably the best known, certainly the most widely publicized" [1] one is the 'Science Citation Index' (hereinafter referred to SCI) which is being brought out by the Institute for Scientific Information, Philadelphia, Pa. since November 1963. It represents one of the first major attempts to provide the scientific community with a multidisciplinary index to the evergrowing mass of literature [2]. This large effort has been the work of a pioneer in the field, Dr. Eugene Gearfield. A detailed description of the various sections of the SCI, its frequency, coverage, search strategy, applications, etc. have been published elsewhere [3, 4, 5, 6]. The advantages and disadvantages of using the SCI as a subject searching tool have also been discussed by Spencer [7].

2 PURPOSE OF THE PRESENT STUDY

The basic objective of this study is to evaluate the usefulness of the SCI as a search tool in retrieving literature concerning a very specific area of bio-medical research.

3 PROCEDURE FOLLOWED

The evaluation of the SCI was accomplished by comparing the entries listed under the specified heading of an already compiled conventional subject bibliography with those obtained from the SCI.

31 Conventional Subject Bibliography

The publication chosen for the purpose of the test is entitled "Work done in India on Viral and Rickettsial Infections of Vertebrates - a Bibliography" (hereinafter referred to as BIB which has been brought out by the Indian National Scientific Documentation Centre, New Delhi, India in 1967 [8]. The entire work of the compilation, "except in a exceedingly few cases", is based on the actual verification of the original sources. The entries of the BIB are classified according to the scheme worked out by Sir Christopher Andrews in his classical work "Viruses of Vertebrates" [9]. The BIB enlists a total number of 3, 267 entries which are arranged chronologically under specific subject headings. The "Medical Subject Headings" list published by the U. S. National Library of Medicine [10] was consulted in assigning the subject headings and preparing the Subject Index to the entries of the BIB.

32 Selection of the Subject

The subject that was chosen for the purpose of testing the SCI was the Haemorrhagic Fevers (Synonym: Haemorrhagic nephritis) (hereinafter referred to as HF). The criteria for selecting this subject were as follows:

1. The subject was extremely specific;
2. It was comparatively recent which posed a new but serious problem in India and elsewhere as well as stimulated further attention being paid to this otherwise benign disease;
3. Investigations in considerable detail and with acceptable significance have been carried out in India and a number of papers have been published by Indian researchers on

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* *Based on a Project Report submitted to INSDOC as a part of its Training Course in Documentation and Reprography during 1966–67.*

this topic. This would, in turn, imply the probability of their citation in the works of the subsequent investigators which would ultimately mean their appearance in the SCI.

33 Collecting the References from the BIB

There were as many as twelve references (as shown in Annexure I) cited under the heading 'Miscellaneous Arboviruses - Haemorrhagic Fever's'. All these entries were recorded on individual slips of 5 x 3 inch size, designated in this article as 'process slips', with their full bibliographic details. These slips were kept arranged first by year of publication and then alphabetically according to author, within any particular year.

34 Searching the SCI

The 1964 and 1965 editions of the SCI were utilised for the purpose of the search. It may, however, be made clear here that our aim to use the SCI was not for compiling any subject bibliography but primarily to ascertain the extent of coverage of the host items enlisted in the BIB. As such, the test carried out to determine the soundness of the SCI as a retrieval tool confined itself mainly to the recording of only the Indian 'descendent' papers corresponding to the particular 'ancestor papers' indexed in the SCI volumes. Nevertheless, the additional cited as well as citing Indian references that were collected from the SCI during the search were also considered for the purpose of evaluation.

341 First Step

The papers in the BIB were considered to have constituted the universe or totality of work since the BIB appears to be appreciably comprehensive in coverage. As a result, it was not necessary to be very specific about the selection of any particular paper in entering the SCI. Any of the twelve host papers would serve the purpose of a starting reference since all of them would ultimately be used in the search-cycle.

The 'target papers' that were covered in the 'Citation Index' section of the SCI were noted and the bibliographic details of each of the 'descendent' papers were recorded in the respective process slips. The references of these citing works were looked up in the 'Source Index' section of the SCI to locate the titles in order to assess their possible pertinence (that is, whether on the subject proper) as well as relevance (that is, whether of interest to the specialists in the field). Whenever possible, the pertinence and relevance were determined on the basis of occurrence of such qualifying words as 'Haemarrhagic Fevers' and 'Dengue', 'Chikungunya Virus', etc. respectively, in the titles themselves. All the pertinent/relevant 'descendent' papers under any particular 'ancestor' or 'target' paper became a candidate for access to the SCI as new starting reference and the process of search was continued in order to conduct a preliminary test on the percentage of retrieval of reference by the SCI, at every subsequent steps of search. If the possible pertinence/relevance could not be determined from the title, the citing references were kept recorded as such in the process slips with asterisk marks to designate them as 'tentatively discarded' items for the time being. The 'target' papers that could not be located in the SCI were also appropriately noted.

342 Second Step

In course of the Frist Step of search, all the cited papers by a given first-named author supplied by the SCI, but not included in the BIB, were recorded on a separate set of slips along with their corresponding citing references. The 'Source Index'section of the SCI was further consulted to ascertain the pertinence/relevance of these new group of 'descendent' papers. The cited items were, however, marked as 'tentatively discarded' since there was no possibility of determining their pertinence/relevance in the abscence of titles in the 'Citation Index' section of the SCI.

343 Third Step

All the 'tentatively discarded' references so far accumulated were checked in the journals in which they originally appeared to determine their pertinence/relevance. The pertinent/relevant ones were simply recorded and counted but were not "re-inserted" into the SCI since it has already been noted that our aim was to compare the SCI's coverage of the host papers of the BIB and not the preparation of any subject bibliography on HF. For the same reason, no additional effort was made to collect more references by the same authors of interest from the 'Source Index' section of the SCI.

35 Re-checking the BIB

The additional pertinent/relevant references that could be retrieved from the SCI were searched back in the BIB through its 'Author Index' in order to ascertain whether they are at all included there (that is, in the BIB) and if so, under which subject heading.

The diagram in page 136 illustrates the search procedure adopted in this study and the follow-up in the BIB.

4 PRESENTATION OF DATA

There were a total number of 12 references, available in the BIB (as in Appendix 1), distributed over nine different first-named authors. Of these 12 papers, as many as 6 or 50% could be retrieved from the 1964 SCI alone, while 3 other papers or 25% was available exclusively in the 1965 SCI. 5 references (about 42%) were found to be common to both the 1964 and 1965 SCI, and only 1 paper (about 8.3%) was obtained as unique reference from the 1964 SCI. As Table 1 indicates, it was possible to retrieve 75% of the 12 target papers by referring to both the 1964 and 1965 editions of the SCI, having recorded the 5 common references against the 1964 SCI.

Table 1: Number and percentage of the articles found in the 1964 and 1965 SCI as against the total papers of BIB

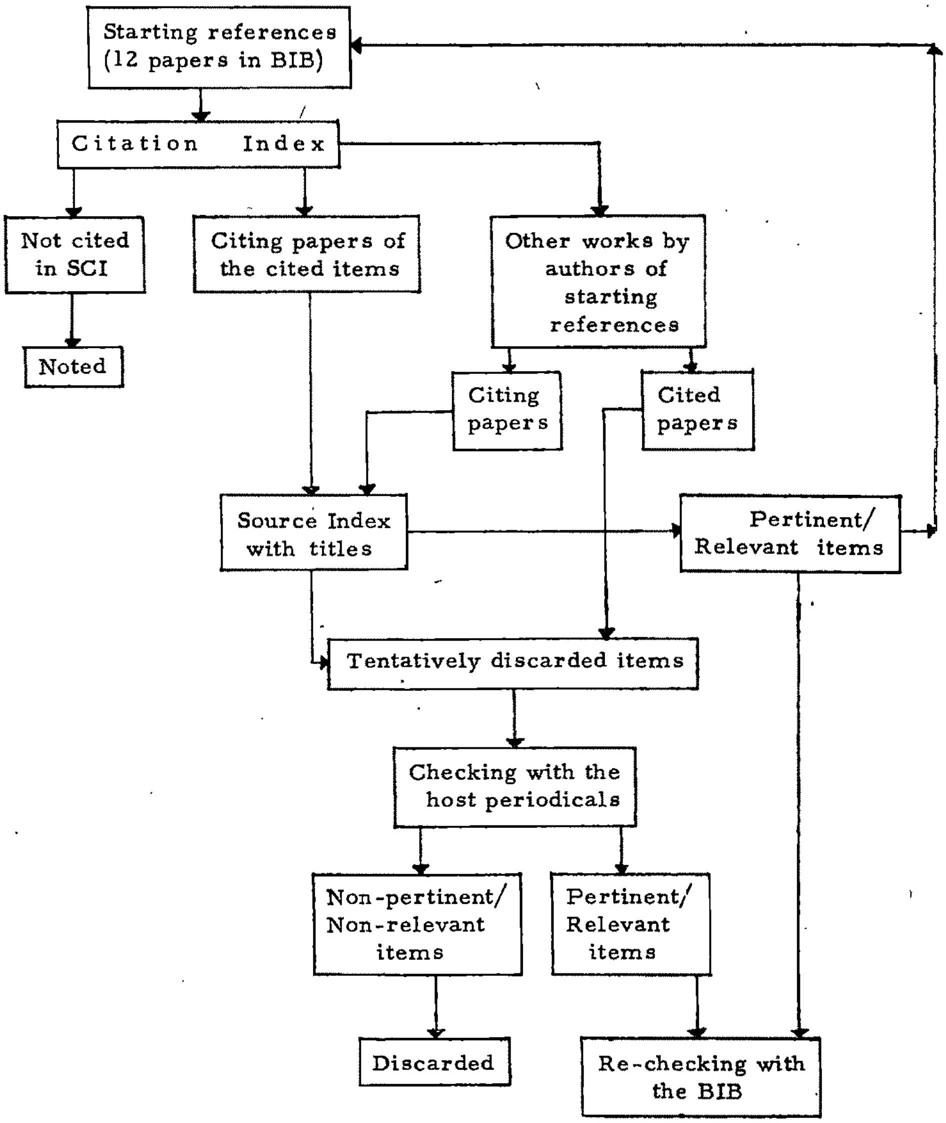
Sl. No.	Author	No. of papers in BIB	No. of papers cited in the SCI			Cumulative total	%
			1964	1965	Total		
1	SARKAR J K	4	2	-	2	2	-
2	AIKAT B K	1	1	-	1	3	25
3	CHAUDHURI R N	1	-	1	1	4	-
4	DE S N	1	-	1	1	5	-
5	KUNDU S C	1	-	-	-	-	-
6	PAVRI K M	1	1	-	1	6	50
7	RAMAKRISHNAN S P	1	1	-	1	7	-
8	RAO T R	1	-	1	1	8	-
9	WATTAL B L	1	1	-	1	9	75
	Total:	12	6	3	9	-	75%

These data would seem to indicate that the retrieval capacity of the SCI (75%), at least for the Indian references on HF, is appreciably high, considering the fact that the SCI covers only one Indian medical journal namely, the Indian Journal Medical Research in its list of "Source Journals".

The 12 papers in the BIB were published in three different Indian journals, the break-up of which is as follows:

Indian Journal of Medical Research	7 nos.
Bulletin of the Calcutta School of Tropical Medicine ...	3 nos.
Journal of the Indian Medical Association ...	2 nos.

Of the 9 papers that were retrieved by the 1964 and 1965 SCI, as many as 7 (about 77.8%) were published in the Indian Journal of Medical


Starting references (12 papers in BIB)
Citation Index
Not cited in SCI
Noted
Citing papers of the cited items
Other works by authors of starting references
Citing papers
Cited papers
Source Index with titles
Pertinent/ Relevant items
Tentatively discarded items
Checking with the host periodicals
Non-pertinent/ Non-relevant items
Pertinent/ Relevant items
Discarded
Re-checking with the BIB

(A diagrammatic representation of the search strategy in the SCI and the re-checking in the BIB)

Research and the remaining 2 were shared by the other two journals. This stands to speak very high of the judicial selection policy adopted by the ISI in preparing the "master list" of source journals for the SCI.

Now let us analyse the citing papers that were found, to be present under the 'target papers' cited in the SCI. Having excluded the common ones, there were a total number of 17 unique citing references which were found to have cited the 9 papers of the BIB. Of these 17 papers, 5 were the host papers that were included in the BIB under the heading 'Haemorrhagic Fevers' and also covered by the SCI as cited works. Of the remaining 12 references, 3 were found to be actually 'on HF' which were enlised in the BIB not under the specified heading namely, 'Haemorrhagic fevers' but under "Chikungunya"; 8 that were 'relating to HF' were recorded, in the BIB, under either the heading 'Chikungunya' or 'Dengue', and the last one was not at all included in the BIB but retrieved only through the SCI.

These figure would seem to support the claim of superiority of concept-orientedness of the SCI over the language-limitedness of a conventional index which results in a scattering of the articles of interest to any group of researchers.

Let us now see the rate of productivity of the SCI so far as Indian literature on and relating to HF is concerned. No strict criterion was however, followed in selecting the 'starting paper'. After arranging the process slips for all the 12 host papers first by chronology and then alphabetically according to the surname of the first-named authors, the very first reference was chosen to start with the search. The process of 'cycling' was repeated until any new reference ceased to appear. The test was carried out, better say to a limited extent, with a view to ascertaining the soundness or otherwise of the SCI as a tool to retrieve the papers of interest, if only one paper (preferably a key-paper) in the field of research, here it is bio-medical, were known to the searcher. In the following productivity chart, the articles on HF and relating to HF have been characterized by the symbols "O" and "R" respectively, while the duplicate or common ones are indicated by "D". Of the articles on HF the ones that are included in the BIB under the appropriate heading namely, 'Haemorrhagic fevers' are marked with an 'asterisk' while those recorded in the BIB elsewhere namely, 'Chikungunya' and 'Dengue' are 'double-asterisked'. Of the articles relating to HF, those that are included in the BIB have been designated by the symbol + and the 'unique references' by the symbol x. The journal entitled 'Indian Journal of Medical Research' and 'Current Science' have been abbreviated to 'IJMR' and 'CS' respectively, and the year 1964 and 1965 to '64' and '65' respectively in the following chart:

Starting Paper

Aikat B K, Konar N R, Banerjee G -
Haemorrhagic fever in Calcutta area.
IJMR 64, 52, 660-75.

1st run

SCI 1964

Pavri K M: IJMR 64, 52, 692	O
Ramakrishna S P: IJMR 64, 52, 633	O
Rao T R: IJMR 64, 52, 727	O
Shah K V: IJMR 64, 52, 676	O

SCI 1965

Dandawate C N: IJMR 65, 53, 707	R +
Krishnamurthy K: IJMR 65, 53, 800	R +
Sarkar J K: IJMR 65, 53, 921	R x
Thiruvengadam K V: IJMR 65, 53, 729	R +

2nd run

Starting Paper: Pavri K M - IJMR 64, 52, 692

SCI 1964

Pavri K M: IJMR 64, 52, 698	R +
Ramakrishna S P: IJMR 64, 52, 633	D
Rao T R: IJMR 64, 52, 719	R +
Rao T R: IJMR 64, 52, 727	D
Shah K V: IJMR 64, 52, 703	R +

SCI 1965

Anderson C R: CS 65, 34, 579	O
Jadhav M: IJMR 65, 53, 764	R +
Rao T R: IJMR 65, 53, 689	R +
Sarkar J K: IJMR 65, 53, 921	D
Singh K R P: CS 65, 34, 480	O

3rd run

Starting Paper: Ramakrishna SP - IJMR 64, 52, 633

SCI 1964

Rao T R: IJMR 64, 52, 727	D

SCI 1965

Thiruvengadam K V: IJMR 65, 53, 729	D

4th run

Starting Paper: Rao T R - IJMR 64, 52, 727

SCI 1964

Not cited

SCI 1965

Krishnamurthy K: IJMR 65, 53, 800 D
Paul S D: IJMR 65, 53, 777 R +

5th run

Starting Paper: Shah K V - IJMR 64, 52, 676

SCI 1964

Ramakrishna S P: IJMR 64, 52, 633 D
Rao T R: IJMR 64, 52, 727 D
Shah K V: IJMR 64, 52, 703 D

SCI 1965

Jadhav M: IJMR 65, 53, 764 D
Myers R M: IJMR 65, 53, 694 R +
Shah K V: IJMR 65, 53, 610 R x

6th run

Starting Paper: Dandawate C N: - IJMR 65, 53, 707

SCI 1965

Tiruvengadam K V: IJMR 65, 53, 729

7th run

Starting Paper: Krishnamurthy K - IJMR 65, 53, 800

SCI 1965

Paul S D: IJMR 65, 53, 777 D
Paul S D: IJMR 65, 53, 790 R +

8th run

Starting Paper: Sarkar J K - IJMR 65, 53, 921

SCI 1965

Not cited

9th run

Starting Paper: Thiruvengadam K V - IJMR 65, 53, 729

SCI 1965

Myers R M: IJMR 65, 53, 694 D

10th run

Starting Paper: Pavri K M - IJMR 64, 52, 698

SCI 1964

Ramakrishna S P: IJMR 64, 52, 633 D
Rao T R: IJMR 64, 52, 719 D
Rao T R: IJMR 64, 52, 727 D

SCI 1965

Banerjee K: IJMR 65, 53, 715 R +
Dandawate C N: IJMR 65, 53, 707 D

11th run

Starting Paper: Ramakrishna S P - IJMR 64, 52, 633

SCI 1964 and SCI 1965

Same as shown under '3rd run' above

12th run

Starting Paper: Rao T R - IJMR 64, 52, 719

SCI 1964

Rao T R: IJMR 64, 52, 727 D

SCI 1965

Not cited

13th run

Starting Paper: Rao T R - IJMR 64, 52, 727

SCI 1964 and SCI 1965

Same as shown under '4th run' above

14th run

Starting Paper: Shah K V- IJMR 64, 52, 703

SCI 1964

Ramakrishna S P: IJMR 64, 52, 633 D
Rao T R: IJMR 64, 52, 727 D

SCI 1965.

Cited only by a foreign author. Hence no further reference added.

15th run

Starting Paper: Anderson C R - CS 65, 34, 579

SCI 1965

Not cited

16th run

Starting Paper: Jadhav M - IJMR 65, 53, 764

SCI 1965

Myers R M: IJMR 65, 53, 694 D

17th run

Starting Paper: Rao T R - IJMR 65, 53, 689

SCI 1965

Dandawate C N: IJMR 65, 53, 707 D
Myers R M: IJMR 65, 53, 694 D
Paul S D: IJMR 65, 53, 777 D

18th run

Starting Paper: Sarkar J K - IJMR 65, 53, 921

SCI 1965

Not cited

19th run

Starting Paper: Singh K R P - CS 65, 34, 480

SCI 1965

Not cited

20th run

Starting Paper: Rao T R - IJMR 64, 52, 727

SCI 1964 and SCI 1965

Same as shown under '4th run' above

21st run

Starting Paper: Thiruvengadam K V - IJMR 65, 53, 729

SCI 1965

Same as shown under 9th run' above

22nd run

Starting Paper: Krishnamurthy K - IJMR 65, 53, 800

SCI 1965

Same as shown under '7th run' above

23rd run

Starting Paper: Paul S D - IJMR 65, 53, 777

SCI 1965

Krishnamurthy K: IJMR 65,53,800 D
Paul S D: IJMR 65, 53, 790 D

24th run

Starting Paper: Ramakrishna S P - IJMR 64, 52, 633

SCI 1964 and SCI 1965

Same as shown under '3rd run' above

25th run

Starting Paper: Rao T R - IJMR 64, 52, 727

SCI 1964 and SCI 1965

Same as shown under '4th run' above

26th run

Starting Paper: Shah K V - IJMR 64, 52, 703

SCI 1964 and SCI 1965

Same as shown under '14th run' above

27th run

Starting Paper: Jadhav M - IJMR 65, 53, 764

SCI 1965

Same as shown under '16th run' above

28th run

Starting Paper: Myers R M - IJMR 65, 53, 694

SCI 1965

Dandawate C N: IJMR 65, 53, 707 D
Jadhav M: IJMR 65, 53, 764 D
De Ranitz C M: IJMR 65, 53, 756 R +

29th run

Starting Paper: Shah K V - IJMR 65, 53, 610

SCI 1965

Not cited

30th run

Starting Paper: Thiruvengadam K V - IJMR 65, 53, 729

SCI 1965

same as shown under '9th run' above

31st run

Starting Paper: Paul S D - IJMR 65, 53, 777

SCI 1965

Same as shown under '23rd run' above

32nd run

Starting Paper: Paul S D - IJMR 65, 53, 790

SCI 1965

Krishnamurthy K: IJMR 65,53,800 D
Paul S D: IJMR 65, 53, 777 D

33rd run

Starting Paper: Myers R M - IJMR 65, 53, 694

SCI 1965

Same as shown under '28th run' above

The data derived from the above 33 runs excluding the common ones, can be summarised as follows:

Table 2: Number of references retrieved from the SCI 1964 and SCI 1965 during the process of 'cycling'

	Item	Numbers
(a)	Articles on HF and included in the BIB under the same heading	3
(b)	Articles on HF and included in the BIB elsewhere	3
(c)	Articles relating to HF and included in the BIB	13
(d)	Articles relating to HF but not included in the BIB	2
Total number of references retrieved		21

Table 3: Number and percentage of new references retrieved at every step (or run) of the search

Stage of Search-cycle	No. of new references retrieved			Percentage
	on HF	relating to HF	Total	
1st run	4	4	8	38.1
2nd run	2	5	7	33.3
3rd run	-	-	-	-
4th run	-	1	1	4.8
5th run	-	2	2	9.5
6th run	-	-	-	-
7th run	-	1	1	4.8
8th-9th runs	-	-	-	-
10th run	-	1	1	4.8
11th-27th runs	-	-	-	-
28th run	-	1	1	4.8
29th-33rd runs	-	-	-	-
Total	6	15	21	100.0

The figures presented in Table 3 indicates that the percentage of retrieval of new references was maximum in the '1st run' (about 38.1%). Thereafter, it starts decreasing which is but obvious. There were several runs which did not give any new reference at all. It is, however, worthwhile to mention here that of the 21 references that could be retrieved from the SCI, 2 (about 9.5%) papers were unique in the sense that they were available only in the SCI and not found in the BIB.

41 Analysis of Data

In course of search with the SCI, a total number of 65 references (including 4 non-journal items) were obtained through other papers of the authors of interest that is, those authors whose works constituted the universe of target papers of the BIB. These 65 references included works of Indian authors other than those of the BIB. Of these 65 references 13 were on HF, of which 5 were included in the BIB under HF itself, 6 were included in the BIB elsewhere, and the remaining 2 were not at all cited in the BIB. On the other hand, of these 65 references, 11 were found to be relating to HF of which, again, 8 were included in the BIB under appropriate heading but the remaining 3 were given exclusively by the SCI. Subtracting these (that is 13 plus 11) from the total we had 41 (65 minus 24) in our hand (including 4 non-journal items) which were found to be absolutely irrelevant (that is, neither pertinent nor relevant to the subject of search). These 41 references account for a very high percentage of 'noise factor' - as high as about 63% - in the use of the SCI as a retrieval tool, at least in the specified field of search as mentioned earlier. On the other hand, the SCI had given a total number of 5 unique references which include papers on HF and relating to HF as well. Hence, compared to these 5 unique references (considering that the papers on and relating to HF are equally important), constituting about 8% of the total papers retrieved, the 'noise' to the extent of 63% is really something worth noting in the SCI.

5 CONCLUSIONS

A few important points which may be focussed in conclusion are:

1. The rate of productivity is much higher in the earlier runs of the SCI search than in the latter runs.

2. Within the small sample, the retrieval efficiency of the SCI was 75%. This is quite high considering the fact that the SCI covers only one Indian medical periodical as source journal.

3. It is also interesting to note that the SCI retrieved at least 2 unique references which are not covered by a bibliography compiled after consulting a number of conventional indexing and abstracting periodicals and also primary periodicals.

4. The 'noise factor' of the SCI due to retrieval of non-pertinent and non-relevant references was as high as 63% in the sample.

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Appendix I

List of papers on 'Haemorrhagic Fever' collected from the BIB.

Virus Study

1. Pavri K M, Banerjee G, Anderson C R, Aikat B K: Virological and serological studies of cases of haemorrhagic fever in Calcutta; Material collected by the Institute of Post-Graduate Medical Education and Research (IPGME), Calcutta. Indian J med Res 1964, 52(7), 692-7.

2. Sarkar J K, Chatterjee S N, Chakravarty S K: Virological investigation on Calcutta haemorrhagic fever. Preliminary report. (Letters). Bull Calcutta Sch trop Med 1964, 12, 2-3.

3. Sarkar J K, Chatterjee S N, Chakravarty S K: Further progress in the study of haemorrhagic fever in Calcutta. Bull Calcutta Sch trop Med 1964, 12, 102-3.

4. Sarkar J K, Chatterjee S N, Chakra-Varty S K, Anderson C R: Virological and serological studies of cases of haemorrhagic fever in Calcutta. Material collected by the Calcutta School of Tropical Medicine. Indian J med Res 1964, 52(7), 684-91.

Case Study

5. De S N, Sen S N, Mukherjee S, Venkatachalam M A: Hepatic necrosis with haemorrhagic fever. J Indian med Ass 1964, 42(12), 557-60 (case study).

6. Kundu S C, Mukherjee P K, Bakshi K B: Calcutta haemorrhagic fever, observations on 15 cases. J Indian med Ass 1964, 43, 464-9.

Epidemiology

7. Aikat B K, Konar N R, Banerjee G: Haemorrhagic fever in Calcutta area. Indian J med Res 1964, 52(7), 660-75. 13 ref.

8. Chaudhuri R N, Chatterjea J B, Saha T K, Chaudhuri A D: Calcutta haemorrhagic fever. Bull Calcutta Sch trop Med 1964, 12, 1-2.

9 Ramachandra Rao T, Anderson C R: Concluding review on the papers on the outbreak of febrile illness with haemorrhagic manifestations in Calcutta. Indian J med Res 1964, 52(7), 727-34. 15 ref.

10 Ramakrishnan S P, Gelfand H M, Bose P N, Sehgal P N, Mukherjee R N: Epidemic of acute haemorrhagic fever, Calcutta, 1933: Epidemiological inquiry. Indian J med Res 1964, 52(7), 633-50. 11 ref.

11 Sarkar J K, Chatterjee S N, Chakravarty S K: Haemorrhagic fever in Calcutta: Some epidemiological observations. Indian J med Res 1964, 52(7), 651-9. 11 ref.

Transmission

12 Wattal B L: Note on Aedes survey of Calcutta following an outbreak of haemorrhagic fever in July 1963. Indian J med Res 1964, 52(7), 710-18.

THE ANGLO-AMERICAN CATALOGING RULES, WITH EMPHASIS ON RULE 3 (WORKS OF SHARED AUTHORSHIP)

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The rules relating to the choice of headings for works of multiple authorship in the Anglo-American Cataloging Rules, 1967 are discussed. The concept of shared authorship and the emphasis on title entry of this revised code are brought out. The rules 3, 4 and 5 are also considered in the light of the four General Principles underlying the rules for choice of heading. A schematic diagram showing the different ways of sharing the authorial responsibility and their corresponding rules for entry is presented.

INTRODUCTION

With the events leading to the release of the Anglo-American Cataloguing Rules, 1967, the 'golden age of cataloguing' has, perhaps, dawned again. Difficulties and discussions in cataloguing are once again furnishing the same 'innocent pleasure and interest' to many of us as they did to Cutter's contemporaries. Initial comments on the new code, which have appeared in print so far, are, as can be anticipated, of very general nature. However, it has been pointed out in a number of comments [6, 11] that Rule 3 (works of shared authorship) is one of the most significant developments in the new code. We propose to discuss in this paper the development and the implications of this new rule in some detail.

IN SEARCH OF PRINCIPLES

Rule 3, we believe, provides us with a very convenient angle to get a close view of some of the principles that underly the rules in the new code. If the previous edition, i.e. the 'A.L.A. Cataloging Rules for Author and Title Entries, 2nd edn, Chicago, 1949, was an alarming maze of rules, exceptions to rules and repetition of rules, it was also this code which triggered off, in a way, the forces leading to a penetrating analysis, rationalization and complete revision of cataloguing rules accumulated since the days of Cutter. In 1953, Seymour Lubetzky asked, and undoubtedly he voiced the feelings of many, "are all these rules necessary? Are all the complexities inevitable? Is there an underlying design which gives our code unity and purpose?"[9]. Lubetzky showed clearly that the 'continuous proliferation and growing complexity' of the rules were due mainly to the fact that the ALA rules were not based on clearly-defined principles, hence they had become a loose 'collection of rules developed to fit specific cases rather than the conditions which the cases illustrated'. This, we believe, is the cardinal point which has guided equally the practising cataloguers in their demands and code makers in their revision work. Surely, Bernice Field had this in mind when she claimed that, "the new rules for entry and heading aim to make cataloging more logical than it is presently by focusing on types of authorship rather than types of works..."[6].

RULE 3 OF THE CODE

With this introduction let us now turn to Rule 3 proper in the new code. The preliminary note attached to this rule shows clearly the scope of it. It would be expedient to quote it verbatim: "The rules below apply to i) works produced by the joint collaboration of two or more authors, ii) works for which different authors have prepared separate contributions (e.g. composite works, symposia, series of addresses, lectures, etc, written specifically for a particular occasion or for the publication in hand) providing the authors are not acting as members of a corporate body, and iii) works consisting of an exchange between different persons (e.g. correspondence, debates). They apply equally to cases of shared responsibility among compilers, editors, translators, adapters, etc., when the applicable rule requires main entry under such a person".

More Comprehensive than the Previous Rule

The above note makes it clear that the Rules 3A and 3B are to be applied to at least three distinct types of publications: 1) works by joint authors, 2) composite works, and 3) works consisting of an exchange between different persons (e.g., correspondences, debates, conversations, etc.). Lubetzky has pointed out that there were as many as sixteen rules — 3A-3E, 4(1)-4B(3), and 5A(1)-5B — to provide for the entry of works by more than one author. The important point to be considered here is how this convenient reduction in the number and complexity of rules could be achieved. The answer is basically what is contained in Miss Bernice Field's statement quoted earlier. For too long our code makers had focussed their attention on types of works, hence separate rules were necessary to deal with each type of works mentioned above. Now, our code makers have found out a very fundamental and significant similarity underlying at a deeper level between these types of works. This is perceptible only when we focus our attention on the question of authorship. The commonness between these works is that in each case authorship is shared by two or more persons. We believe, the expression 'works of shared authorship' is very profound and most appropriate.

Commenting on the Rule 2 (Work of Avowed authorship) in the 'Code of Cataloging Rules' (CCR), Paul Dunkin also held a similar view. He said, "This sweeping reduction in the number and complexity of ALA rules in this and other areas results from the fact that CCR considers works only with regard to authorship while ALA considers works with regard to their type or form and requires a rule or set of rules for each type or form. Yet the rules for one type may easily involve the same principle as that applicable to another type"[10].

First Author vs Principal Author

Now let us come back to a consideration of Rule 3. It will be evident from what have been said about the scope of the rule that works by joint authors and composite works are to be treated alike. This may sound too drastic. In fact all codes had very carefully preserved the distinction between works of joint authorship and composite works. The ALA Rules was no exception to that. It had maintained the distinction by Rule 3 and Rule 4. Bibliographically the distinction may be of some significance but if we ask why should there be any distinction made in their cataloguing practices, then, the answer may not be very convincing. If we accept Jolley's criterion of authorship, i.e., to the cataloguer authorship does not connote the intellectual responsibility alone but also the name most permanently and consistently associated with a particular work, then one has to accept also, as Jolley would put it, that "twenty-one equal authors [i.e. when no one is represented as principal author] will not provide a name to attach to a work whether their contributions are merged into one whole or are separate and labelled"[8]. It may be reminded here that the ALA Rules had preserved the distinction in a most arbitrary way. The general rule for works by joint authors recommended entry 'under the first author mentioned on the title page' (Rule 3) and the rule for composite works recommended entry 'under the author chiefly responsible for the work, first mentioned on the title page, or under title...' (Rule 4). It may be mentioned here that the British Museum Rules recommend the entry of a composite work under the 'name of the first author' only (Rule 15(ii))[3]. This shifting emphasis and hesitancy would make one suspect that neither of these two rules is based on any sound principle. However, three important points need to be taken note of in this connection. Firstly, in the treatment of works by joint authors the emphasis was on the first-mentioned author exclusively whereas in the treatment of composite works the main emphasis was on the chief author. One can easily think of cases where even for works by joint authors the responsibility may not be equally shared or there may be an author or authors chiefly responsible. Secondly, this concept of principal authorship was germane in the ALA Rules but it was applied only in the treatment of composite works. It would be shown in the latter paragraphs of this paper that in the new code this concept has been applied very consistently for the treatment of all works where the authorship responsibility is shared. We believe this is an important development in the new code. Thirdly, in the ALA Rules (Rule 4) there was no indication as to how the chief responsibility or the principal author is to be determined. Here also the new code has introduced some refinements.

No Specific Rule for Festschriften

Before we go on to consider the above points, which involves a consideration of the underlying principles, let us examine the implications and effects of the comprehensive new Rule 3 from another angle. The old specific rule 5A(1c) for a very important type of publications, i.e., Festschriften has been eliminated. We find a very interesting picture in the treatment of Festschriften in the various codes. Although there is diversity of practice so far as the choice of heading is concerned but all codes have one common aspect in that all of them give equal emphasis on the importance of this type of work by providing specific rules for the choice of heading and added entries. Hence, non-provision of any specific rule in the new code surely demands closer examination and we need to know how exactly such works are to be treated.

Who is the 'Author' of a Festschrift

If we keep in mind Jolley's very pragmatic criteria of authorship, i.e., the term implies the concept of both intellectual responsibility and of the name most permanently and consistently associated with a work, then it can be easily seen that in deciding the authorship of a Festschrift we have difficulty. Undoubtedly, the name of the person honoured will be most permanently and consistently associated with such a work but no stretch of imagination can confer the right of authorship on this name from the point of view of intellectual responsibility. It is quite natural that Cutter, in his anxiety to supply a 'natural heading' for every entry would prefer the name of the person honoured, in the heading. That is exactly the recommendation of his rule 108. The British Museum rule (15 iii, exception) also suggests similar treatment. But this rule introduces a highly arbitrary distinction as it (exception) is not to be applied to memorial volumes and centenary publications, it is meant for Festschriften presented to living persons only. Surely, life and death are important facts but from cataloguing point of view completely irrelevant. The Joint Code of 1908 (rule 126:2) had recommended entry under the society or institutions (when published by a society or an institutions) or under title, with added entries under the editor and the person in whose honour the collection is published. According to the ALA Rules (Rule 5A(1C)) the entry was to be under the society or institution (when published by a society or an institution) or under editor if the editor's name appears prominently in the publication, otherwise under title. Subject entry under the person in whose honour the collection is published is to be given. Thus it would be evident that even the previous edition of the code was able to get over the temptation of Cutter's 'natural heading', and also it recognised the importance of editorial responsibility of such publications. In the new edition of the Code, as has been said, there is no specific rule for Festschriften. They are to be treated like any other works of shared authorship (Rule 3) or any other 'works produced under editorial direction' (Rule 4). We shall presently discuss and demonstrate how such works are to be treated by applying the basic rules of 3 and 4.

GENERAL PRINCIPLES

In the foregoing paragraphs we have considered the significance of Rule 3 from the point of view of its area of application and have seen that it is a very comprehensive rule, taking care of at least three major types of works and uniting them all through the common characteristics of shared authorship. In the subsequent paragraphs we propose to discuss its significance from another angle. It is known that the rules in the new code are based on some accepted principles. In the entire code, we feel, Rule 3 in association with Rules 4 and 5 carve out an area where we can see the most conscious application of these principles, or the logic behind the rules. This is an important development in the new code and which, all cataloguers will welcome. Incidentally, in the subsequent paragraphs, we will also attempt to gather the loose ends of our thoughts, kept-hanging in earlier paragraphs, and weave them on along the general pattern of discussion.

Chapter 1 (Entry) introduces the general principles as:

1) Entry should be under author or principal author when one can be determined.

2) Entry should be under editor when there is no author or principal author and when the editor is primarily responsible for the existence of the work.

3) Entry should be under a compiler named on the title page in the case of collections of works by various authors.

4) Entry should be under title in the case of other works whose authorship is diffuse, indeterminate, or unknown.

The First Principle and Rule 3

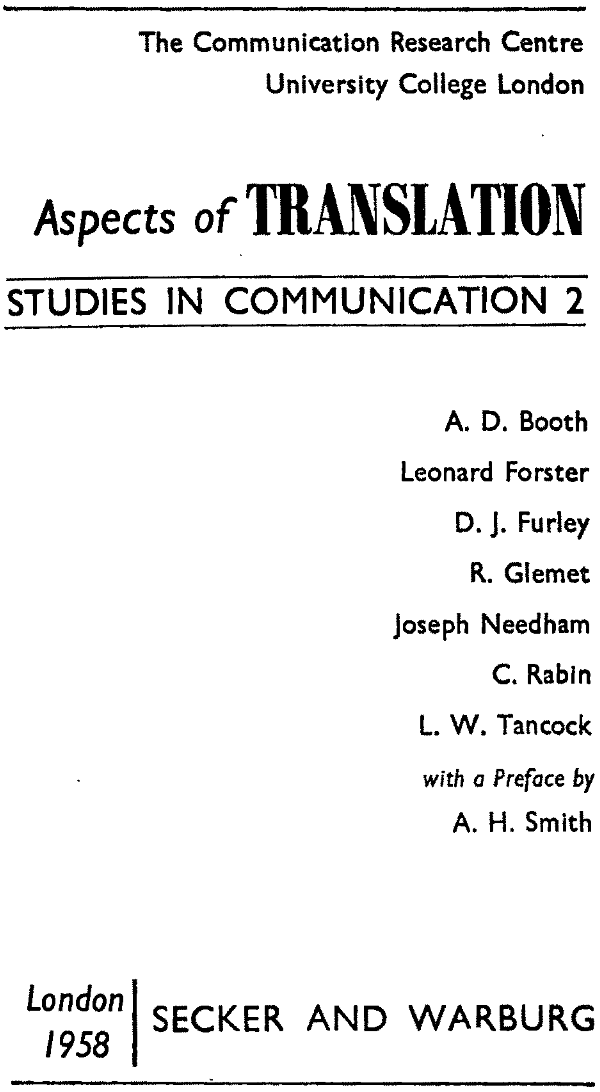
Taking the first principle into consideration, surely the concept of 'principal author' is a significant development. As has been pointed out earlier this concept was germane and applied only to composite works in the previous edition of the code. Now this is to be applied to all cases of multiple authorship. A very pertinent question here would be how this is to be determined. While discussing this point at the Paris Conference Dr. Ranganathan had commented that, "the onerous task of judging who was the principal author should not be left to the cataloguer, instead it should be made clear that he was to be guided by the information found in the book", and he suggested the addition of the phrase, 'as indicated on the title-page or in any other part of the book' [7]. This was not, however, accepted by the Conference. In the circumstances, we are particularly happy to note that the new code, has accepted this useful suggestion, as would be clear from the wording of its Rule 3A. It reads, "Enter a work of shared authorship under the person or corporate body, if any, to whom principal responsibility is attributed, e.g. by wording or typography." Lubetzky had maintained that "... the most important characteristic of the book, for the purpose of cataloging, is the fact that it is provided with a prominent identification tag in the form of a title page. The cataloguer can thus anticipate how a particular book will normally be cited and looked for and provide for it accordingly" [9]. But this simple direction was made obscure at times by pretentious cries like, 'it is the book and not the title-page which is to be described'. Hence, with this clear direction to rely solely on the title-page to decide an important issue like the principal author, we can definitely say that we have come back to the 'relaties of the title-page'. In fact this has been made very explicit in Chapter 1 (page 9) of the Code, where it is mentioned, 'the entry for a work is normally based on the statements that appear on the title page, or any part of the work that is used as its substitute' (denoted by the term 'title-page'). This stand has been maintained very consistently by Dr. Ranganathan and the principle itself was given by him earlier by what he calls the Canon of Ascertainability.

From what have been said above it follows that in the choice of heading for a work of multiple authorship the first deciding factor would be the indication or not of a principal author (by wording or typography).

The Second Principle and Rule 4

When the first principle alone cannot decide the issue, we have to apply the second principle. Here also we find a very significant difference in the approach of the new code. For, in the previous edition, in all the rules for the types of works we are considering, viz. works of joint authorship, composite works and works consisting of an exchange between different persons, editorial responsibility in general was not considered to be important enough to enter such works under the names of editors. Only in one instance, in Rule 5A(1C), a festschrift was prescribed to be entered under editor if it was not published by a society or an institution. Now, in all types of works of multiple authorship (when no one is represented as principal author and there are more than three authors) if the editor appears to be primarily responsible for the existence of the work, the entry can be under the name of the editor, provided two more conditions are satisfied i.e., he is named on the title page of the work and the publisher is not named in the title. The present rule 4A reads, "enter a work produced under editorial direction under its editor provided: 1) he is named on the title page of the work, 2) the publisher is not named in the title, and 3) the editor appears to be primarily responsible for the existence of the work." So, here again is an instance where the new code has focussed attention on types of authorship, in this case editorial responsibility, rather than types of works, like works of joint authorship, composite works or works consisting of an exchange between different persons.

About the practical application of this rule we have to make two comments. Firstly, the preliminary note to this rule makes it clear that this rule applies only to such of these works (multiple authorship) as are not serials and do not involve questions of corporate authorship, other than the responsibility of the publisher. This means that if a corporate body is entirely responsible for the editorial direction and is also named, the entry cannot be under the name of the body, if we have in mind this rule alone. To make this point clear let us consider the following example. The title-page of the publication is reproduced below:



The Communication Research Centre
University College London

Aspects of **TRANSLATION**

STUDIES IN COMMUNICATION 2

A. D. Booth
Leonard Forster
D. J. Furley
R. Glemet
Joseph Needham
C. Rabin
L. W. Tancock
with a Preface by
A. H. Smith

London
1958
SECKER AND WARBURG

The work is a composite book having seven contributions from as many authors and their names are arranged alphabetically. The actual order of the contributions is different. It would be evident that there is no indication of any principal author either by typography or by wording. Application of rule 3 will indicate entry under the title. But there is something more in the title-page to be taken note of. The name of a corporate body, the Communication Research Centre, appears very prominently. On examination we find that the preface has been signed by A.H. Smith in his capacity as the secretary of this Centre. The preface also makes it clear that the Centre was responsible for planning the 'symposium' and for the existence of the work. Hence, it is possible to consider the Centre to be chiefly responsible for the work. Applying rule 4A(1) of the previous edition of the code the entry can be under the name of the corporate body. It may be added that the B.N.B. had entered the work under this heading (rendered as: London. University. University College. Communication Research Centre). But Rule 4 of the new code cannot be applied in this case, even if the primary responsibility 'for the existence of the work' has been established, as this rule is not to be applied to cases involving questions of corporate authorship. It can be mentioned straightaway, as otherwise we shall be going outside the scope of this paper, that Rule 17 is to be applied in such cases. Well, all this was to show the implications and the exact scope of Rule 4.

The second comment we want to make is that this rule does not provide any hint as to when an editor is to be considered primarily responsible as has been given in the case of principal author. We just want to say that some guidance in this direction could have been easily given, and this will be apparent in the next section when we consider the third principle along with the next rule.

The Third Principle and Rule 5

The third principle whish is about collections, is fairly simple and the Rule 5 completely takes care of this. The Rule 5A is only for such collections as have collective titles. The rule reads as follows: "If a collection of independent works by different authors, not written specifically for the same occasion or for the publication in hand, or of extracts from such works, has a collective title, enter it under the person who compiled it when he is named on the title page as compiler or editor...". In the wordings of this rule, the qualifying clause 'not written specifically for the same occasion or for the publication in hand' is very significant in one respect. The main distinction between Rule 4 and Rule 5 and the types of work they are to cover respectively is that Rule 4 treats of works of multiple authorship where individual contributions are written specifically for the same occasion or for the publication in hand, naturally the editor playing a more important role, whereas under Rule 5 are treated works the contributions of which are not written in a similar way. So, by this comparison, we feel, it would have been better if Rule 4 had brought out this distinguishing feature, by appropriate wording, as that would have given some guidance also as to how and when an editor is to be considered primarily responsible for the existence of a work. The Rule 5B takes care of collections without a collective title.

The Fourth Principle and Rules 3, 4 and 5

If the most prominent identification tag of a book is its title-page then surely two most reliable and important items in it are the name of the author and the title of the book. But which one to prefer for entry — the name of the author or the title? All modern codes have given the preference to the name of the author for a number of reasons. Whatever may be the relative merits and demerits of these two items from the point of view of ascertainability, permanency, etc. there is one great social implication at the root of this preference. This has been most succintly brought out by Jolley in these few words — "We enter a book primarily under its author because in our present stage of civilization individual intellectual responsibility for a book is considered to possess a special importance. We think of books first as the works of individual authors"[8]. It follows naturally that when the name of the author is not mentioned or unknown, the title would be the only remaining clue to identify a book. Since the days of Panizzi, all cataloguing rules had accepted this stand and Cutter saw in it the 'two great principles' of cataloguing. As we consider the present Fourth Principle in relation to the other three principles, we hear an echo of Cutter's 'two great principles'. But what is more important is that mingled with this echo we hear something more, some voice not heard before. We intend to focus here this new development.

Author vs. Title Re-examined

Out of the two most dependable and valid clues for the identification of a book, viz. the author and the title, the 'two great principles' had given the preference to the former but never denied the importance of the latter. But, an analysis of our rules for the choice of heading can easily reveal that, in fact, we have been giving disproportionate importance and emphasis to the former. Only in a few instances our rules recommend entry under title, and that too as a last resort. This is evident if we just consider for a moment headings consisting of a name followed by such subdivisions as, 'Spurious and doubtful work', or 'Supposed author'. This tendency is much more evident in corporate headings like 'Geneva. Citizens', 'Baltimore. Merchants' or 'London. Women'. Our rules had recommended the entry of works even under such made-up and uncertain headings in preference to titles. This discussion prompts us to say that all books may be grouped, from this point of view, under three broad categories, viz.
1) works whose authorship is known and certain
2) works whose authorship is uncertain or that is by a group that lacks a specific name; and
3) works whose authorship is unknown. The made-up headings that we have quoted above show that our rules have been harbouring a distinct preference for entry under author, not only for the first category but also for the second category. This is clearly reflected in the relevant rules of the ALA code. Thus the general rule 32 recommended, "Enter works published anonymously under author when known. Rule 140 recommended, "Enter reports of meetings or committees of citizens not belonging to any named body or class and having no definite name, under the name of the place with subheading CITIZENS". Again rule 141 advised, "Enter anonymous publications of any class of citizens (not organized) under the name of the place with the name of the class as subheading. . . " The new code, by a single rule (2A), has completely reversed the position. It reads, "Enter under title a work that is of unknown or uncertain authorship, or that is by a group that lacks a name". Hence we find here a distinct preference for entry under title, for the works belonging to the second category mentioned above. We believe, this is a true rehabilitation of the 'two great principles'.

Authorship Diffuse

In the wording of the Fourth Principle we also find that title entry is to be preferred even for those works whose authorship is 'diffuse'. Within the purview of the rules and the type of works we are considering in this paper, the best example of the application of this part of the Principle is supplied by rule 3B2. It reads, "if no one is represented as principal author and there are more than three authors, enter the work under its title... " So, here are cases where authorship is known and certain, yet title entry is preferred because authorship responsibility is diffused. It means title entry has claimed a part of the first category also.

Law of Impartiality Satisfied!

In principle each one of the several authors of a work of multiple authorship (specially in the case of joint authorship) has equal claim to be considered for heading. This is the message of the Law of Impartiality. At the same time, for very practical reasons of economy in time, labour and cost, we want to draw a clear line of demarcation between 'few authors' and 'many authors'. This has necessarily to be arbitrary to some extent. In view of the common team work habit amongst scientists and the resultant works usually being of multiple authorship, it would be expedient to include as many authors as possible under the category 'few authors'. The ALA Code had drawn this line of demarcation between three and four authors. But the treatment of works on either side of the demarcation line was almost same, as both the categories were to be entered under the first mentioned author. For a work with more than three authors, the author statement could omit the names of all authors, except the first, and consequently avoid giving added entries. Of course this practice was whetted by Rule 3:6C of the Rules for Descriptive Cataloging (Library of Congress).. Now, the revised code recommends completely different entries for these two categories. For the first category, the entry is under the first named author, and for the second category, when there are 'many' authors (defined as more than three), the entry is to be under title. This means that when there are many authors, even the first author loses his claim to the heading of the main entry. This is a point which will be hotly debated. But, we can see the rationale behind this rule in Jolley's observations. He said, "...universal convention recognizes two names in permanent association as having the same function as a single name. This is not a cataloguer's invention but extends to legal firms, fashion shops, publishers, etc". "To how many names does this principle extend? To three at least but beyond that it is more doubtful. It is certain that if twenty-one names appear on the title page with equal prominence their names cannot cohere to form a joint name" [8]. So, in such cases where it is difficult to find a name which will be closely and permanently associated with a book, it is surely advisable to depend on the other equally reliable identification mark of a book, which is the title. It may also be pointed out that to ignore the claims of all authors, when there are many authors, to the heading of the main entry is only another way to satisfy the Law of Impartiality.

Schematic Diagram

In this last section we are giving the summary of rules for the treatment of works by multiple authors in a schematic diagram (see page 151). It would be evident that now the deciding factor in determining the choice of main entry heading would be the nature of sharing of the authorship responsibility. We are to focus our attention on this point, instead of trying to find out, for the publication in hand, whether it is a work of joint authorship or a composite work, a festschrift honouring a living person or a memorial volume, an exchange of letters between different persons or collection of letters, etc. Let us take the case of festschriften again, because, as we have pointed out before, the revised code has not provided any specific rule for this type of works. If we now look at a festschrift from this new point of view of authorship responsibility surely a festschrift too will fall under one of the categories represented in the schematic diagram — it may have three or more than three authors or contributors, one of them may be indicated as the principal author, it may be produced under editorial direction and the contributions written for the particular occasion, or it may be a collection of already published works only collected for the occasion by a compiler and so on, and the choice of heading will be determined accordingly. The fact that a particular publication is in the form of a festschrift need no longer by itself determine the choice of heading. Surely, this is simplification and rationalization of cataloguing rules at its best.

Let us conclude with these words of Paul Dunkin: "... The new code is not a conglomeration of little rules to deal with special little questions. Rather it is a statement of broad rules resting on basic principles. This does not mean that the new code will not answer special little question. 'Love God; love your neighbour' does not tell you every time and every circumstance — or even what kind of God or what kind of a neighbour. But anyone with any imagination at all will find that the rule answers more questions than a code maker could think of in a lifetime" [10].

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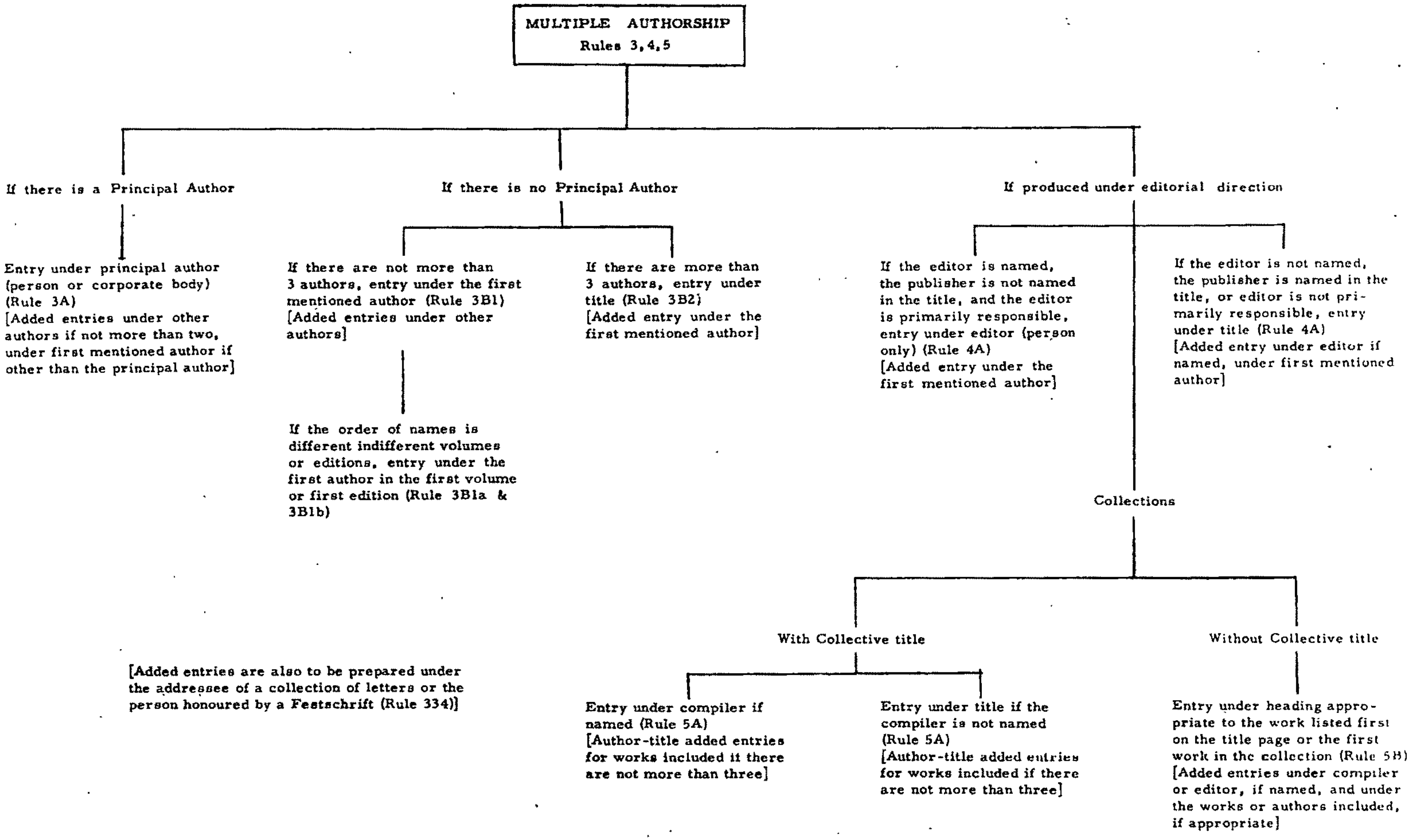

MULTIPLE AUTHORSHIP
Rules 3,4,5
If there is a Principal Author
If there is no Principal Author
If produced under editorial direction
Collections
With Collective title
Without Collective title

Entry under principal author (person or corporate body) (Rule 3A) [Added entries under other authors if not more than two, under first mentioned author if other than the principal author]

If there are not more than 3 authors, entry under the first mentioned author (Rule 3B1) [Added entries under other authors]

If the order of names is different indifferent volumes or editions, entry under the first author in the first volume or first edition (Rule 3B1a & 3B1b)

If there are more than 3 authors, entry under title (Rule 3B2) [Added entry under the first mentioned author]

If the editor is named, the publisher is not named in the title, and the editor is primarily responsible, entry under editor (person only) (Rule 4A) [Added entry under the first mentioned author]

If the editor is not named, the publisher is named in the title, or editor is not primarily responsible, entry under title (Rule 4A) [Added entry under editor if named, under first mentioned author]

Entry under compiler if named (Rule 5A) [Author-title added entries for works included if there are not more than three]

Entry under title if the compiler is not named (Rule 5A) [Author-title added entries for works included if there are not more than three]

Entry under heading appropriate to the work listed first on the title page or the first work in the collection (Rule 5B) [Added entries under compiler or editor, if named, and under the works or authors included, if appropriate]

[Added entries are also to be prepared under the addressee of a collection of letters or the person honoured by a Festschrift (Rule 334)]

ON CURRENT AWARENESS SERVICES*

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Considers 'Current Awareness Service' as one of the techniques evolved by the documentation profession to solve the 'information explosion'. Defines the scope of the term 'Current Awareness Service'. Discusses the various patterns of such service along with the levels at which service could be offered. Discusses some general principles for the evaluation of Current Awareness Service. Describes briefly some of the important 'Current Awareness Services'. Suggests some improvements with a view to increase efficacy of the service.

INTRODUCTION

The exponential growth of scientific literature coupled with its scattering nature presents several problems. Some of these are:

1. No one individual, no one organisation, and no one country could identify or acquire with certainty all the documents that contain useful information;
2. No individual could read, much less retain in his memory all of the recorded information that might be of current or future interest to him; and
3. The traditional library tools are becoming progressively less effective as the volume of the material grows and the needs of the individuals become more specialized.

Specialisation has become a necessity to overcome some of these problems. It has been only through specialisation that the individual could succeed, to some extent in reducing the continuing growth of knowledge to manageable proportions. But now, owing to the interdisciplinary nature of various subject disciplines, the individual must keep abreast of knowledge outside his narrow speciality, if he is to work efficiently. Hence, it appears that even specialisation provides only a partial solution to the problem of information explosion.

Any method by which access to recorded knowledge to be provided rapidly, conveniently, economically and precisely to a research worker has to depend upon others. The delegation of the tasks of literature search to others by the researcher brings the following professionals into the picture:-

1. The Librarian;
2. The Editor (both Primary and the Secondary) of the technical periodical;
3. The Abstracter; and
4. The Indexer

From what has been stated above it can be inferred that: the emergence of documentation is a natural consequence of the literature explosion; the documentation profession evolved a variety of tools and systems (such as abstracts, indexes and the application of mechanized methods for processing information etc.) in the hope of promoting efficient utilization of recorded knowledge in the cause of Science and technology; and the method developed for keeping the Scientists abreast of the Current developments in the field of their specialisation is known by the name 'Current Awareness Service'.

CURRENT LITERATURE

The term Current Literature usually connotes nascent or newly created literature. It may also mean, the literature that is in vogue or in currency. The term has been interpreted by one scientist [16] to mean the body of original literature published in a given month. Every field of scientific research demands the knowledge of current literature on the part of the scientist if he is to make

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Based on a Project Report submitted for the training course in Documentation and Reprography conducted by Insdoc during the year 1965–66.

worth while contribution to the advancement of knowledge in that field. 'It is better if the scientist has information on what is being worked out today and planned for tomorrow in other laboratories working on the same or similar problems in all parts of the world'[15]. But, how could this task be accomplished by the scientist? That is exactly where current awareness service comes into the picture.

DEFINITION AND SCOPE

Any effort made to bring current literature to the notice of research workers could be termed as Current Awareness Service. But we define the term as 'a system of service which ensures that all the information likely to influence the progress of a research worker or a research team is made available to them in the right time and in a convenient form'. The sole object of such a system of service would be to ensure that research is not delayed or conducted inefficiently because of the failure to obtain potentially available information and that earlier research is not duplicated. Obviously, this interpretation of the term 'Current Awareness Service' does not strictly enforce the one month time limitation for the literature to be considered as current. However, we would like to emphasise that promptness and coverage keyed to the needs of a particular group of scientists and the ease of use are the most important factors that must be considered in the designing of any current awareness service. Current awareness service is being provided in different patterns and at different levels. Each of these patterns and the levels (i. e. Local, National and International) at which this service could be rendered effectively are discussed in the following paragraphs.

PATTERNS OF SERVICE

For the sake of convenience, Current Awareness Service could be divided into some definite groups. The Chart in page 154 presents such a division. The main characteristics applied in the division are:-

1. Entry element;
2. Arrangement; and
3. The Physical Form

Considering the first of the characteristics namely, the entry element, we have the following categories of the service:

a) Title of periodical as the entry element;

b) Title of individual article as the entry element; and

c) Words in the title of the article as the entry element.

Each of these could be sub-divided using the second and the third characteristics as indicated in the chart.

Title of the Periodical as the Entry Element

The assumption that a research worker or a group of such workers select a few important periodicals in their subject of interest and feel satisfied if they could scan these periodicals, appears to be the basis for this service. This approach has a validity in the umbral or core region of the work. Most of the highly specialised workers appear to be guided by this approach. To satisfy the above approach of research workers, current awareness services wherein title of the periodical is used as the entry element, have come into vogue. This type of service is popularly referred by the name Index-by-Journal. In this service a periodical is regarded as a single unit. Contents pages of periodicals in any specific subject are reproduced and arranged alphabetically either according to the title of the journal or according to the broad subject groups. The list thus produced is disseminated. This method provides an easy approach for searching and purposeful scanning of a limited but important group of periodicals.

Evolution of Index-by-Journal System

This system was first designed by the friends of Armed Forces Medical Library in the year 1940 for assisting the physicians in the form 'Current List of Medical Literature'. In this, the table of contents of selected periodicals were reset in a standard type and reduced in size to get the maximum number on a single page. It grouped the journals in classes-anatomy, physiology and so on to permit a rapid review by the physician of a field or fields of interest. [12] Another venture in this direction was the "Guide to Russian Scientific Periodical Literature" started in 1948 by the Library at Brookhaven National Laboratories, in Upton, New York. In the above two cases, contents pages of journals were collected, reset and arranged after the journals had been published. These were not re-

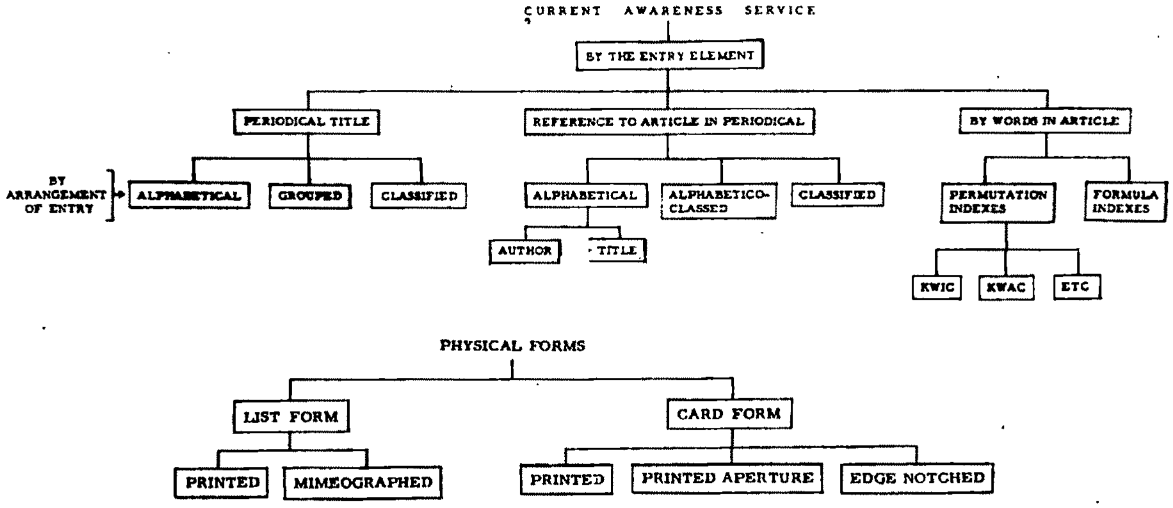


Chart showing the groupings of Current Awareness Services by Entry Element, Arrangement, and the Physical Form.

produced directly. Hence, considerable amount of editorial work was involved in the above services.

Contents in Advance

In the production of 'contents in advance' the method of direct reproduction of tables of contents was used for the first time. This was produced on an experimental basis by Eugene Garfield in 1956. The greatest advantage of this method was reduction of compilation and editorial work and enhanced speed of service. This system is now being employed in the production 'current contents'.

Article as Entry Element

Owing to the developments in Scientific communication and the practice of (technically referred to as seepage) important articles of one subject occurring in journals devoted to other subjects, it becomes difficult to keep moderately well-informed about the progress made in a subject. To obviate this difficulty services wherein periodical article is considered as a single unit, have come into being. According to this method journals are first scanned or entries are prepared on the basis of details obtainable from the contents page. They are then arranged either by using a classification scheme or grouped alphabetically under their broad subjects, the sub-arrangement being according to the name of the author of the article. In the preparation of these entries standard cataloguing practice is followed. The final list thus obtained is either printed or cyclostyled and disseminated. This procedure involves a lot of compilation and editorial work and as such quick service could not be rendered by this method.

Significant words as the Entry Element

As specialisation grew in intensity, the scientist began to search for literature in his field of specialisation by means of technical terminology pertaining to his subject. To suit this approach, new types of current awareness services have been designed. Soon, there appeared services where significant and meaningful words picked up from the articles are used as entry element. These words are arranged in an alphabetical sequence with or without the context in which they have been employed in the original articles. Recent advances in computer technology have ushered the production of Permutation, Keyword in Context (KWIC) Keyword Away from Context (KWAC) and the Citation Indexes. Chemical Titles (CT) may be cited as the earliest example of such a current awareness service.

Presentation Trends

A careful analysis of the recently produced current awareness lists such as "Chemical Biological Activities" (CBAC), 'Current Papers in Physics' (CPP) and Current Papers indicates that the new trend of presentation is a compromise between the traditional subject approach and the fancied journal approach by the scientists. In other words, the new trend attempts to synthesise these two approaches into a unified one.

LEVELS OF CURRENT AWARENESS SERVICE

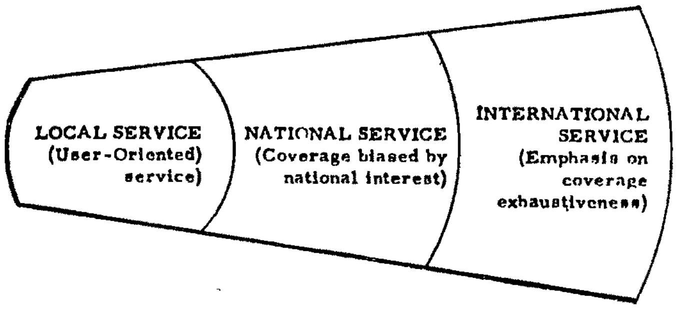
The concept of levels is applicable to current awareness service only from the point of view of production. In other words, if the compilation and production agency is of international nature, or the production effort is shared by more than one nation for a particular service, it may be said that the service is an international one. It is difficult to apply this concept from the consumption point of view as it is equally difficult to visualise the division of Science as Afro-Asian Science, Asian Science and Indian Science. This means, that the very nature of Science being international from the consumption point of view every level of service (i. e. international, national or the local) will have international scope.

International

The purpose of this service would be to cater for the current awareness needs of scientists all over the world without any discrimination. Such service could be an all pervasive one, covering all subject fields or it could be one limited to a particular subject field. An omnibus current awareness service like the Universal bibliography is neither possible to accomplish nor is desirable. Such a service is beset with the practical difficulties like: (1) Collection of information about the current literature being produced in different languages of the world, its processing and dissemination poses problems like that of finance, technical manpower; and (2) The clientele being an undefined one, the efficacy of such a service could not easily be assessed.

It appears no such service is in existence today. The other possibility is to have current awareness service limited to one subject field. International societies in a special field such as crystallography, microscopy are the best organisations to undertake this service. This implies comprehensiveness in coverage. The problem is how to determine the exhaustiveness of any current awareness service? It is to be determined on the basis of the number of journals scanned for the purpose or by any other criteria? To judge the comprehensiveness by counting only the number of titles may be misleading. For, a recent analysis on the journal productivity has revealed that only 250 journals produce as much as 50% of the abstracts in the Chemical Abstracts and after that the law of diminishing returns comes into play so that the remaining 750 journals produce only 25% of the abstracts (i. e. the first 1000 journals producing 75% of the total abstracts) a second 1000 journals increase the productivity only by 10% and the third 1000 titles add only 5% [1]. This only demonstrates that in any subject field if proper selection be effected, 250 journals cover as much as 50% of the worthwhile literature in that field. However, comprehensiveness should not be attempted at the cost of speed, as speed is the very essence of current awareness services. Current papers in Physics could be cited as an example of cur-

LEVELS OF SERVICE



rent awareness service at an international level. Chemical titles, Bioresearch titles and Chemical and Biological Activities though, strictly not organised on international basis are very useful for a wider clientele.

From what has been stated above the main factors in the organisation of current awareness service at an international level appear to be proper selection of the number of periodicals to be included in the service and the adaptation of suitable compilation techniques which result in the speedy production and dissemination. However, such services some times tend to be too general and do not satisfy the specific requirements of any particular type of users.

National

The research activities of the country are to be carefully considered before any attempt is made to provide current awareness service at a national level. Service should be so oriented as to meet the literature needs of research and development in a country.

The essential difference between an international and a national service lies in the fact that the former should attempt to provide comprehensive service while the latter strives to provide service tailored to the research needs of a particular country. In a national service selectivity of the material is biased towards the national interest. 'Express Information Service' provided by VINITI could be cited as an example of such a service.

Local

The need for prompt reporting of new information has in recent years stimulated a new communication media called local documentation list. This service is some times known by the name 'In-house Current Awareness Service'. Many special libraries and documentation units attached to scientific and technical organisations provide this type of service. Mainly the research and technical staff of the respective organisations form the clientele to this service. The merits of current awareness at local level are:

1. Clientele is limited and their needs could be gauged very precisely;
2. A Local Service System can incorporate a user feed-back, thereby, being constantly alive to the changing interests of its users; and
3. Selectivity of material and the user to whom it is directed could be achieved in an effective manner. Similar opinion is reflected by Mr. Voigt [12].

The concept of levels of Current Awareness Service has been graphically depicted in the figure given in page 155.

EVALUATION TECHNIQUES

For any Service system, there must be a method of evaluation. Evaluation is necessary in order to optimize and maximize the efficacy of the system. The performance characteristics of any system are expressed by the terms efficiency and efficacy with which the system is achieving its goal. It must be pointed out here, that although the total efficiency of the system is dependent on its components yet, it is not the arithmatical or linear expressions of the efficiencies of the components. In the overall evaluation of any system, there are certain basic principles which can be deemed as minimum necessary steps. These are:

1. Establishing the functional criteria of the system;
2. Establishing the performance characteristics; and
3. Establishing and standardising test

   procedures for the system and for the components.

Normally, functional criteria for a 'Current Awareness Service' are its stated objects. In other words, these are limited by the scope, clientele and the nature of service. However, it becomes necessary to test the validity of these objectives periodically as the very nature of the service is such, that it is so much user dependent, that a minimum change in the user approach is likely to make the service obsolete and ineffective.

The criteria for the performance characteristics of the components of the system are to be established first independently for each component and then for the entire subsystem. The components that normally go in 'Current Awareness Service' are sub-systems like acquisition, classification, cataloguing, indexing and dissemination; user; the skilled and the semi-skilled persons; and machines like type-writers, duplicating or printing machines; processing machines like semi-automatic machines handling punch cards or computers. The role of each of these in the entire service has to be ascertained and evaluated from time to time, vis-à-vis their performance, efficiency and efficacy. It must be pointed out here, that a particular system selects a particular type of configuration of components with a view to achieve the stated objectives.

There are no prescribed set, or universally accepted standards for comparing the performance of a component, sub-system or the entire system. During the course of the service these standards have to be evolved and tested from time to time till the profession is able to provide standards for evaluation. That is to say that the performance of a classifier or indexer is much dependent on the scheme of classification or the system used. At present even these schemes do not provide any working standards.

Some times even the very sub-systems like classification or cataloguing need evaluation in the light of the changing context provided by the user.

Human Factors

'Current Awareness Service' is highly dependent on human beings for its source material, compilation, processing, production, dissemination and use. This service can be viewed as the system of interactions of human beings. 'Human beings have individuality, and only under extremes of controlled conditions can human reactions be predicted. A controlled experiment involving a person is possible, but difficult to arrange, and is feasible only for limited activities' [17], definitely not for intellectual activities like the ones called for in the compilation, production and the use of 'Current Awareness Service'. Consequently, human factors cannot be ignored in any attempt for evaluating the service as a whole or the performance of a component or a sub-system.

It has not been possible to trace any attempt for evaluating 'Current Awareness Service' at the international level. At best a component or a sub-system of such a service might have been evaluated but not the system as a whole.

Assessment

At the national level attempt has been made in India by the Indian National Scientific Documentation Centre, to evaluate the efficacy of the 'Insdoc List of Current Scientific Literature'. The test procedure adopted in this method was as follows: A list of clientele was prepared from the records maintained at the centre. Questionnaires specially designed for the purpose were sent to all of them. The research workers who used the list frequently were asked to complete the questionnaire and send it back to the centre. A team of workers specially constituted for the purpose personally interviewed the research workers and recorded the results of their interviews. The complete results of this attempt have been presented in the form of a report [14].

On local level such experiments are being conducted in places like Atomic Energy Establishment, London. It may be stated that most of the 'user studies' are directed mainly towards the evaluation of the information systems. As with public opinion polls, the validity of such results is a short lived one and cannot be applied for all times. However, local services must incorporate the periodical evaluation of the efficacy in their operational routines.

SOME EXISTING SERVICES

The subsequent paragraphs present a study of some of the existing current awareness services.

A. Current Contents

This is a weekly service issued by the Institute of Scientific Information, Philadelphia. It is presented in two series, A & B. Series A confines itself to space and physical sciences and was started in the year 1961. Series B includes in its scope chemical pharmacomedical and life sciences. Each series covers about 600 selected journals in the respective fields.

Current Contents consists of three parts: The alphabetical part contains the list of periodicals covered in that particular issue giving the reference to the page numbers where those journals are featured. The second part consists of the table of contents of the periodicals. The contents pages are reproduced and grouped without any obvious arrangement. The third part is the author directory. It is an alphabetical list of the names and addresses of authors.

Current Contents can be considered as an example where index-by journal method is followed. The author directory helps the research workers in contacting the author of the paper.

Though, this service is primarily designed to meet the needs of American clientele, its utility is not limited to America alone.

* Since 1967 'Current Contents' is appearing in three series. The third series is entitled 'Current Contents-Chemical Series'. A special feature of the new series is that it incorporates 'Permuterm Index' and structural diagrams of chemical compounds in addition to the usual features mentioned earlier. IBM 360 is utilized in the compilation of the 'Permuterm Index'. This index provides subject approach to the 'Current Contents' and enhances its use.

B. Current Chemical Papers (CCP)

It is a monthly publication published by the Chemical Society, London.

Current Chemical Papers was started in 1954. The purpose of this service is to report new papers in pure chemistry.

Unlike the 'Current Contents' in this service article and not periodical is treated as a single unit. The entries in CCP are arranged alphabetically under 13 broad subject headings. The coverage is highly selective and only 450 journals are scanned for the purpose. The CCP is noted for its speed in listing current material.

The entries in CCP are arranged alphabetically under 13 broad subject headings. The coverage is highly selective and only 450 journals are scanned for the purpose. The CCP is noted for its speed in listing current material.

C. Chemical Titles (CT)

Chemical Titles is the publication of the American Chemical Society designed to provide current awareness service. It started its publication in the year 1960. Chemical Titles covers the fields of pure and applied chemistry and chemical engineering. It is a biweekly service. About 700 journals are scanned for the purpose of this service.

Chemical Titles is in three parts. The first part consists of an index in which Keywords from titles of articles are arranged alphabetically in the central column. Along with these Keywords the index contains as much of the remainder of the titles of the articles as could be programmed on the computer within the space available in the column. The additional matter nearly always furnishes a clue to the nature of the work and should be regarded as the context facilitating the selection of relevant titles. The second part is a bibliographical listing of titles of current papers from selected journals in the form of tables of contents. The journal reference is provided at the top of each table of contents. The specimen entry furnished below illustrates the point more clearly.

Specimen Entry

Brit. J. Appl. Phys., 18, No. 11 (1967)

```
BJAPAJ-0018-1497  LANCEFIELD MJ         SCHOFIELD P
                  THERMAL-NEUTRON MILNE PROBLEM.=        1497-516
BJAFAJ-0018-1527  BROWN MACS            PORTEOUS P
                  TECHNOLOGY AND PROPERTIES OF EPITAXIAL INDIUM ARSENIDE
                    LASERS.=                             1527-36
BJAPAJ-0018-1543  HALE JC
                  HALL EFFECT MEASUREMENT IN SEMICONDUCTING CHALCOGENIDE
                    GLASSES AND LIQUIDS.=                1543-50
BJAPAJ-0018-1551  BURDETT CF            LAYNG RE
                  MAGNETIC DAMPING IN GADOLINIUM.=       1551-8
BJAPAJ-0018-1559  OWEN EA               EVANS EW
                  ATOMIC VIBRATION AMPLITUDES IN TWO ALLOYS.  SILVER-COPPER
                    AND GOLD-COPPER.=                    1559-66
```

The third part is an alphabetical index of all authors of papers mentioned in each issue of Chemical Titles along with the reference code for the paper. Chemical Titles is the first computer produced current awareness service. IBM 407 and 1401 are used for the purpose of production.

D. Chemical-Biological Activities

Chemical-Biological Activities (CBAC) is a current-literature index to the biological activity of organic compounds. It is being published by American Chemical Society since 1964. The publication is computer-based to achieve rapid information dissemination. The subject areas covered by CBAC are:
(1) Organic compounds that act on biological systems exclusive of botanical Kingdom;
(2) Animal and microorganism metabolism studies; and (3) In vitro chemical reacting of organic compounds of biochemical interest.

Pertinent articles from approximately 300 journals are covered in each issue of CBAC. CBAC is published twice in a month.

Chemical-Biological Activities has four sections:

1. Digest Section;
2. KWIC Index;
3. Molecular Formule Index; and
4. Author Index

The digest section contains the core information arranged to facilitate rapid review of the research results contained in new papers. The Keywords in both the titles and digests are indexed in the KWIC Index. The Molecular Formula Index Lists the molecular formulas by increasing number of carbon atoms. The Author Index lists all authors alphabetically. The special feature of CBAC is that it provides both subject approach as well as the journal approach.

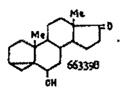
Arrangement

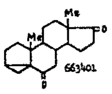
The entries in the digest section are arranged first under the abbreviated form of the name of the journal. Coden form is followed in abbreviating the titles of the journals in CBAC. The sub-arrangement is according to the title of the article and not according to the alphabetical order of the surname of the author.

Specimen

Nature, 206, Nos. 4987, 4989, and 4990 (1965)
1099 METABOLISM OF 6β-HYDROXY-3,5-CYCLOANDROSTAN-17-ONE BY RABBIT LIVER IN VITRO.
NATU,206,4987,65,933
Davidson OW, Fotherby K(Univ. Edinburgh, Scot.

The metabolism of
663398 6β-Hydroxy-3,5-cycloandrostan-17-one by rabbit LIVER in vitro yielded a metabolite which was identified as
663401 3,5-Cycloandrostan-6,17-dione.


663398


663401

The digest as shown in the above entry serves the purpose of an indicative abstract. Another special feature that could be noticed in the above entry is that the research station of the author of the article is also provided in the Digest Section of the CBAC. These features make it an ideal Current Awareness Service.

E. Current Papers in Physics (CPP)

"The CPP is a new current awareness service started by the Institution of Electrical Engineers in association with the Institute of physics, the Physical Society, and the American Institute of Physics. It has been given a format and featuring which is quite distinctive. The format is like that of a small size newspaper. The featuring of articles in it is a well thought out combination of broad subject and journal approach. The entire list is divided into about 20 broad subject headings which are printed in bold face. Under each of these headings, listing is by the titles of the host periodicals and issue numbers. Under any title of periodical, the order of the articles, if more than one, is the same as is found in the contents page of that issue. In effect this would mean that the contents of a catch-all type periodical like the Physical Review will be scattered under a number of subject headings, while almost the entire contents of an issue of a periodical dealing with a specific field in physics, like the Journal of the Acoustical Society of America, would be found under the subject heading Acoustics. The CPP is produced by the most conventional methods of production and printing" [8].

SUGGESTIONS

We have seen that two major objectives which any Current Awareness Service aims to achieve are (a) to select and bring to the notice of a research worker the exact information from current literature, in his field of interest and (b) to supply this information as quickly as possible. Hence when we think of bringing in any improvements in such service we have to think of them along these two lines i. e. (a) how to make the service more intimate and realistic to the needs of its users and (b) how to minimise the time-lag between the publication of primary periodicals and the notice of their contents in such a service. This study indicates the following suggestions for improving the efficacy of current awareness services:

1. If the service is to be organised at a national level, which may be economic, implying thereby that the service is to meet the collective needs and interests of a large group of research workers, the agency responsible for the service must maintain something like an up-to-date file of research-in-progress in the country for the proper selection and presentation of matter in the

Current Awareness List. There should also be provision for periodical evaluation of the service.

2. To minimise the time-lag the practice of using contents pages as the basis for compilation of Current Awareness Lists is steadily gaining ground. To make this practice really effective the following changes are essential.
    (a) The contents pages should be treated as individual entities and should be made marketable commodities so that they could be purchased in the market like the journals.
    (b) They should contain complete information as regards the name of journal, volume and issue numbers, etc. The contents page should include full address of the authors, the initial and the inclusive page numbers, broad subject headings, and annotations to the articles with their titles.
3. In view of the growth of KWIC index type of lists, the responsibilities of authors are great in supplying meaningful and meaty titles and proper references to their articles for the success of such indexes.
4. To bring in the above mentioned changes in the contents page a close cooperation between the authors and the journal editors is suggested.
5. Documentalists should devote some energies for developing performance and service standards for current awareness services. To begin with these standards should be prepared for local level of service.
6. Local current awareness services should be regularly evaluated for their effective performance. This is necessary to avoid a dangerous pitfall of the service becoming a mere 'ritual'.

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CURRENT DOCUMENTATION LITERATURE

LIST OF PERIODICALS COVERED IN THIS ISSUE

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American Documentation [Amer Doc]	18(3)
Annals of Library Science and Documentation [Ann Lib Sci Doc]	14(2)
Archives [Archives]	8(37)
ASLIB Proceedings [ASLIB Proc]	19(6,7)
Babel [Babel]	13(2)
Book Mark [Book Mark]	26(10)
Canadian Library [Canadian Lib]	24(1)
Data and Control Systems [Data Control Systems]	(4)1967
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Hawaii Library Association Journal [Hawaii Lib Ass J]	23(2)
IASLIC Bulletin [ASLIC Bull]	12(3)
Indian Library Association Bulletin [Indian Lib Ass Bull]	3(1,2)
Information and Documentation [Inf Doc Japan]	9(5,6,7)
Information Storage and Retrieval [Inf Stor Retr]	3(1,3)
International Association of Agricultural Librarians and Documentalists [Int Ass Agric Libn Doc Quart Bull]	12(1/2)
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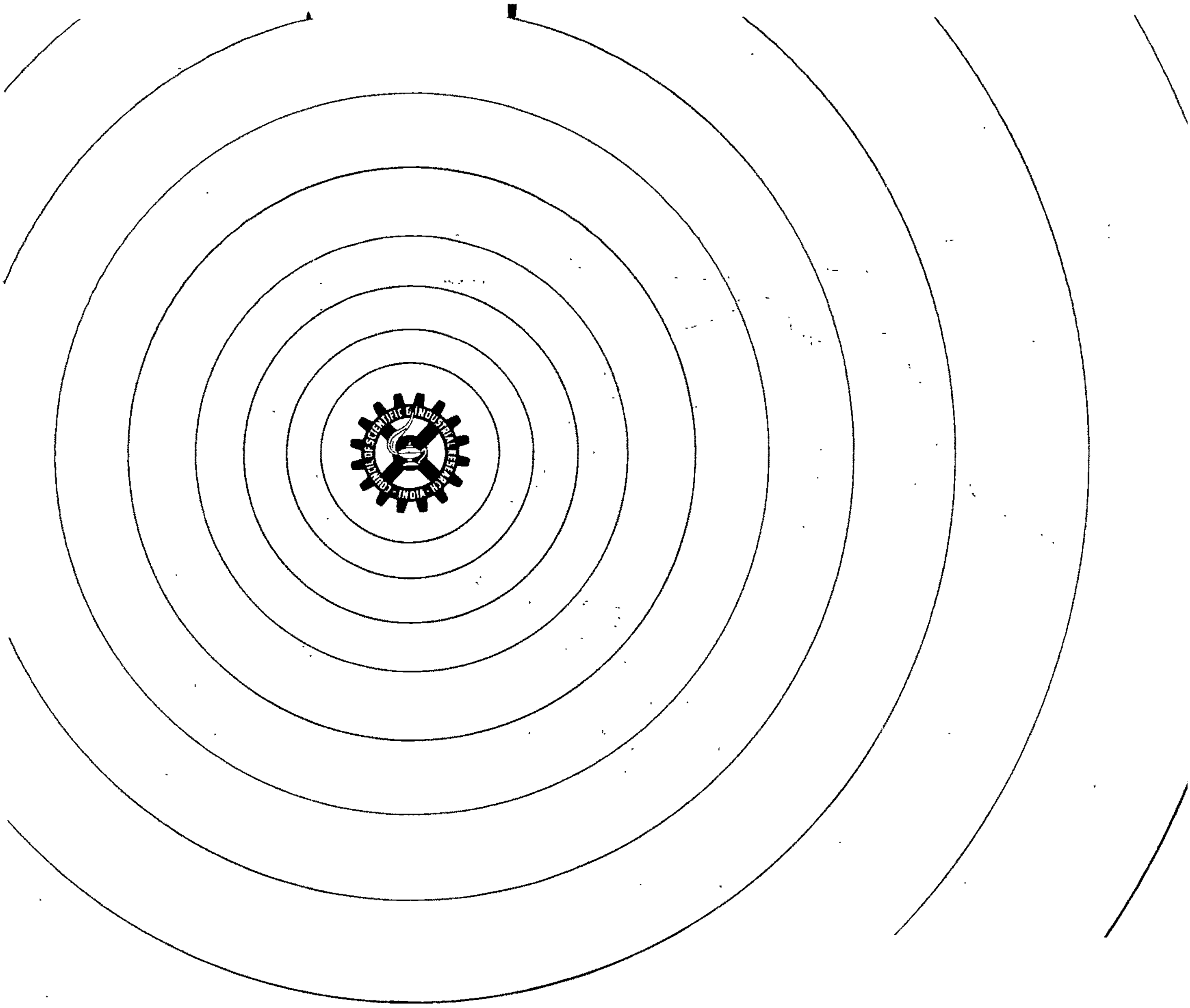

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EDITORIAL

With this we complete the fourteenth volume of the Annals. In this volume we have published 18 articles and we believe we have been able to present some good reading material on matters of current interest. The first two issues were mainly devoted to information processing by computer, a topic in which general curiosity is gradually giving place to active interest. With the appearence of the machine produced Keyword Index for the Indian Science Abstracts, the interest in such matters has been intensified. The 'man-machine interaction' that goes on to produce this index in the monthly issues of the Indian Science Abstracts, has been explained in two articles (Raizada et al., p. 20-33; Bose and Dutta, p. 122-32). An article on another topic of interest viz. Selective Dissemination of Information (SDI) appeared in the second issue (Polzovics, p. 57-61).

Some of the project reports submitted to Insdoc's training course in Documentation and Reprography have been of good standard. To make them available to a wider reading audience, three papers based on such project reports have been published in this volume. They are on Computerised data retrieval (Haravu & Raizada, p. 76-88), on Current Awareness Services (Satyanarayana & Raizada, p. 152-60) and on Science Citation Index (Ghosh, p. 133-42).

The year under review will stand as a landmark in the history of cataloguing with the release of the long-awaited Anglo-American Cataloguing Rules. With it interest in cataloguing has been revived. We have been able to publish two articles on this new code during the year (Guha & Rajan, p. 143-51, Rajan & Guha, p. 206-11).

The present issue carries an article which not only surveys the reprographic facilities available in the country but also makes a few suggestions for the development and better utilization of our meagre facilities (Nagarajan, p. 194-205). It is hoped in the future issues to include more contribution in this very important field subsidiary to documentation practices.

The present issue also carries an article (Bannur & Purandare, p. 182-86) which needs to be mentioned. The authors seem to underwrite what some of the elder scientists have always been saying, namely, that all the international cooperative facilities in the way of current awareness services cannot possibly ever do away with the scientist's own initiative in finding for himself the latest advances in his field of work.

The Editorial Committee is glad to announce that beginning with the first issue of Vol 15, 1968, a new section carrying Letters to Editor and Short Communications will be added. To make this new section a lively medium for exchange of ideas, contributions in the form of comments or short communications on any topic of interest to our profession are invited from our readers.

B.S. Kesavan

ON THE POSSIBILITIES OFFERED BY UDC AND SOME DESCRIPTOR RETRIEVAL SYSTEMS — A COMPARATIVE STUDY

A A FOMIN
All-Union Institute of Scientific and Technical Information (VINITI), Moscow

Observations, in the light of some experiments, are made on the comparative efficiency of the UDC and descriptor retrieval systems. The grammar and logic of the two systems are analysed and compared with search examples. It is claimed that UDC schedules can be taken as a basis for a universal thesaurus for all subjects in a generally accepted international language.

An experiment is being carried out in the USSR at present to compare UDC with some descriptor systems based on the assumption that, with a respective technique, UDC can be effectively used in the fields which have been recently referred to as a realm of descriptor systems, for the so-called "multiple-aspect" retrieval in particular.

Retrieval language is the basic element of any retrieval system. The semantic range of most descriptor retrieval systems is mainly determined by the richness of their vacabularies. The grammar of a retrieval language is generally rather primitive; moreover, a great many (if not most) descriptor systems now in operation have no grammar at all, and one mustn't take for granted that they are in any way inferior to grammatical systems. Thus, as the first step, we can restrict our discussion to comparing UDC with grammarless descriptor systems.

With this restriction in mind, it is true that of two systems serving one and the same field of knowledge that system will be better one whose language has words to denote more concepts to operate with.

UDC language consists of indexes, special and general descriptors, which are, in fact, the words of this language. As a rule, UDC words are translated into a natural language dissimilar to those of descriptor languages. Thus the descriptor "electric motor" will appear in the document searching image whenever it is desired that the document should be given in answer to information requests containing the word "electric motor". One can say that individual words or fixed word combinations act as analogues of descriptor words in a natural language. If the word 621.313.13 appears in a document searching image, it usually means that the general idea of the document is associated with electric motors, while the actual word "electric motor" may be altogether omitted from either the document or the text of the inquiry, or both. Thus with usual-type application of UDC some semantic aspects of texts written in a natural language act as counterparts (analogues) of UDC words. A characteristic feature of UDC indexing lies in the fact that it is desirable to reflect in the searching image the general idea of document contents alone, its major (in the indexer's opinion) conceptual aspects. This fact underlies the hindrances in the application of UDC while answering specific inquiries (multiple-aspect retrieval); it is the same circumstance that hampers comparison of UDC language with descriptor languages.

The situation is to change radically should a translation into UDC language be close to a word-for-word translation from a natural language (which is generally done for descriptor languages). Thus, let us assume that the word 621.313.3 is a translation of the word "electric motor"; in this case promising opportunities are opened for multiple-aspect UDC indexing. With such a "descriptor" technique of indexing the relative value of UDC and descriptor languages is to a great extent determined by a comparison of their dictionaries. In this connection, UDC dictionaries compiled for the section "Amplifiers" were compared with a descriptor dictionary developed for the same section. It was found that out of the 530 words of the descriptor language only 74 had no counterparts in UDC language.

---

* *Paper presented at the 33rd FID Conference, Tokyo, 1967. Reprinted by the kind courtesy of the author.*

Logic is an important element of every retrieval system. Here we include the basic relations between the words of the retrieval language and the rules for comparing the searching images of requests and documents. Basic relations are understood as relations between the words of the retrieval language independent on context.

The logic of the system is necessary to establish relevance between an inquiry and a document. Almost in all modern retrieval systems, both classification and retrieval ones, the process of relevance estimation is carried out nonautomatically, by human intellect. The logic of such systems is used by man as a help. Thus the technique of comparing searching images of documents and inquiries is such that the searching images of documents retrieved are to include all the words of the inquiry searching image. Therefore while indexing a document, one also tries to introduce into their searching images the words associated with those available in the text though not actually found in the text as such. This is done to provide for different wording of probable inquiries. In some descriptor systems conceptual relations between the words are not fixed (there are no basic relations), and thus indexing is based entirely on the indexer's experience and intuition.

In other descriptor systems basic relations can be found and the indexer can proceed from conceptual relations between the words included in the dictionary, that is, thesaurus.

UDC is provided with well-developed basic relations, and its tables can be referred to as the thesaurus - dictionary of the system. Still the inherent deficiencies of basic relations in UDC are caused by the fact that they were formulated irrespective to the purpose of retrieval, but based on some ideas relative to classification of human knowledge. As a result some words denoting identical or related notions are dissociated.

Thus, it is desirable for convenience of retrieval that the thesaurus of the retrieval system should contain, relative to the word "trolley-bus", some more general terms, such as "motor cars" and "transport aids", which has actually been done in descriptor systems. In UDC the concept "trolley-bus" in the section "Electrical engineering" is denoted by the word 621.335.43 (supplied with a more general word 621.335.4 - "motor cars"; in the section "Transport" this concept is represented by an entirely different word 629.113 62.

And yet, UDC has some means of overcoming this deficiency - it is references (see " ——→ ") which may serve to classify into groups different words which are equivalent or closely related. For instance the word 621.335.43 is supplied with a reference (see "621.113.62"). One can be certain that in this way UDC basic relations can be so transformed that they suit a convenient technique of indexing and operation.

UDC multiple-aspect indexing is usually associated with the necessity of repeated duplication of cards which results in inevitable swelling of files. This can be easily avoided should UDC be realized on "Uniterm" - type or peek-a-boo cards.

Let us consider an example to illustrate the idea. Assume that a collection served by a descriptor system has some Document No 15, whose searching image consists of the following descriptors: "electric motor", "three-phase current", "protective devices", "design". The appearance of this document in the retrieval file is shown in Chart 1.

Searching image of the document in a descriptor system

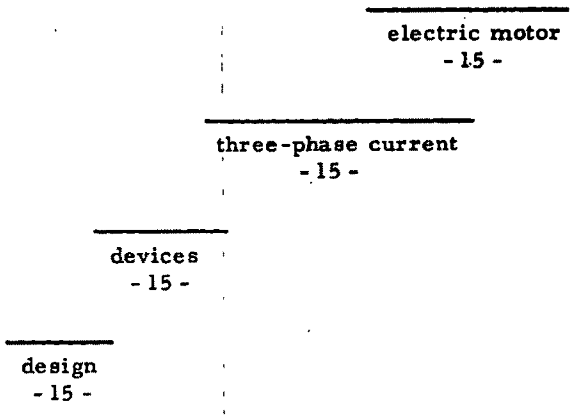

Chart 1

When UDC is used, the searching image will look as follows:

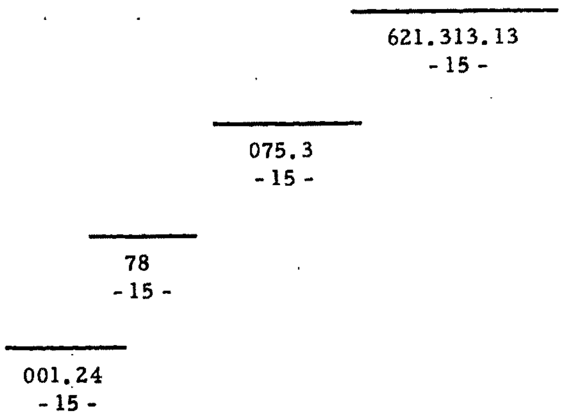

Chart 2

The same can be similarly done on peek-a-boo cards. Thus, like with the usual inverted realization of descriptor systems, there are two files: the information file consisting of numbered abstract cards, and the retrieval file consisting of uniterm or peek-a-boo cards.

These are the prerequisites of the experiment the purpose of which is to ascertain the possibility and efficiency of using UDC in a "descriptor" regime (coordinate indexing regime).

Comparison was made for a document file at one of the Central branch information institutes for the section "Amplifiers" indexed according to a descriptor system.

The experimental file was a random selection from the acquisitions of the reference collection during May and June 1966. It contained 500 abstracts of articles and patents published in VINITI Abstracts Journal and elsewhere.

The file was restricted to the types of amplifiers included in UDC 621.375 (valve, semi-conductor and magnetic amplifiers) except for electromagnetic amplifiers 621.375.6.

Abstracts and summaries were treated as final documents in the sense that neither during indexing nor while estimating relevancy primary sources of information, such as articles, books, etc., were addressed.

The ordinal numbers of the abstracts were used as their addresses.

The system was realized on peek-a-boo cards.

As already noted, each document was indexed in accordance with both systems (UDC and descriptor ones).

Indexing by UDC was performed as follows: every word of the text, which was a term and related to the description of an amplifier, was translated into UDC language. The searching image of the document did not include the terms describing objects incorporating an amplifier as a component but only terms concerning the amplifier itself. (For instance, while describing a TV set amplifier, no characteristics of the set, such as size, weight, etc., were included into the searching image of the document.)

On the average, the number of words in the document searching image was:

for UDC	20 words	per document.
for the descriptor system	6-8 words	

The difference can be explained by the relative abundance of UDC dictionary as compared to the specially developed descriptor system.

30 searches were carried out to 30 inquiries specially compiled for the experiment purpose. The inquiries were formulated in such a way that they:

a. may be asked under real conditions;

b. have answers in the experimental file.

Example: "Balanced heat-resistant semiconductor speech amplifiers without transformer at their output." or

"Broadband valve VHF amplifiers with the band-pass of 40-220 megs and signal amplitude 0.5 to 1.0 v."

The following results were obtained:

1. In the UDC indexed document file the noise factor was 9 per cent, and loss factor 8 per cent. (The losses (completeness) were estimated by scanning the entire document file).

2. In the descriptor indexed document file the noise

factor was 32 per cent.
loss factor was 23 per cent.

The analysis revealed that the major mistakes were due to inadequate methods of indexing.

An attempt was made to correct the method of indexing by introducing complex indexes by means of colon and some other symbols, such as the subtraction sign "-", the symbol "∧", "∨" denoting "much", "little".

Example: .011.21:049.61 - input impedance, where
011.21 - impedance
049.61 - input
016.35 - stable
016.35 - unstable
016.2 - high power
016.2 - low power

The new method was used to index a new file of 800 documents. There is a reason to hope that the new method will minimize the losses and noise of the 1st experiment due to - elimination of wrong associations (power, input resistance, - the document dealt with input power and had the term 'resistance', while at the output the document discussing input resistance might be omitted); - formalization of the process of indexing (it is expected to do the indexing in accordance with an alpha betic - subject index (ASI) which minimizes human factor in indexing identical documents.

No	Words and word combinations carrying a semantic load in the text of information source	UDC codes and descriptors
1.	hybrid (transistor + valve)	621.375.2'4
2.	D.C. amplifier	.024
3.	negative feedback	621.375.432:621.375.43
4.	high input impedance	.011.2:.049.61:.011.2
5.	low anode voltage	.015.1:.032.22:.015.1
6.	base bias circuit	621.372:.032.271:.015.1:.032.271
7.	cathode repeater	621.375.232.3;621.375.232;621.375.23
8.	anode repeater	621.375.232.5;621.375.232;621.375.23
9.	to measure 10^{-13}amp current	621.317.32;621.317.3;621.317.014:.049 .61;.014;.024.1;.024.12;.024.126;
10.	coefficient of amplification	1.091.2
11.	balance modifications	
12.	circuits	.061

While preparation of ASI is complex enough, indexing operations are by far simpler than with traditional UDC indexing.

At present searches are being made (100 searches have been planned to make) to requests of a more complex nature as compared with those of the 1st experiment.

One of the indexed abstracts is shown below.

IB410. UDC 621.375.432.024:621.385

Laishley F.H. Low voltage, high input impedance hybrid amplifier circuits. "Electron. Engng", 1964, 36, No 435, 309-311,353,362. (In English; French and German summaries).

Consideration is given to negative feedback D.C. transistor amplifiers with a very high input impedance as a result of the introduction of electronic valves at their input. Use is made of low anode voltage triodes connected in the D.C. base bias circuit, the valve operates as a cathode or anode repeater. Whenever electrometric triodes are used, the amplifier can be employed to measure currents up to $\sim 10^{-13}$ amp. For such a circuit the voltage amplification coefficient is $\sim$ 1. Balance modifications of the amplifier circuit are cited [4 refs.].

[The descriptors and the UDC codes of the above abstract are shown in page 180]

Information source searching image

621.375.2'4;0.24;621.375.432;621.375.43;
.011.2;.049.61;011.2;.015.1:.032.22;.015.1;
621.372:.032.271.015.1:.032.271.621.375.
232.3;621.375.232;621.375.23;621.375.232.5;
621.317;621.317.31;621.317.3;014:.049.61;
.014;.024.1;.024.12;.024.126;.091.2;.061

If the experiments prove successful, it will become possible to approach UDC tables as a basis for a universal thesaurus of world-wide spread compiled in a generally accepted international language (Arabic figures) amendments to which are introduced by a special international agency - FID Central Classification Committee, which contributes to the general nature of this thesaurus for all nations of the world.

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PERSONAL DOCUMENTATION — A STUDY

B B BANNUR

G M PURANDARE
Hindustan Antibiotics Ltd.
Pimpri, Poona-18

Defines and outlines the meaning of personal documentation. Utility and purposes are discussed. An experiment has been carried out to study the difference between the documentation carried out in information centre and in personal documentation. Explains how the special librarians and information scientists make use of personal documentation.

INTRODUCTION

The human brain and the memory are biological marvels that outcompute the computer in the realm of the generation and association of ideas but not in the realm of the storage and retrieval of information. A man becomes frustrated when he knows that somewhere he has seen a piece of now desirable information but he does not quite know, just where. In case of human memory, unfortunately, the storage system is usually poorly organized and the retrieval system is 'chancy', at best, and totally inadequate. Therefore, human memory needs a mechanical aid or crutch such as a filing system.

In India, as we know many professionals (i.e. physicians, engineers, scientists) mainly depend on their memory as far as their personal information storage is concerned. Only a few of them jot down the references in their notebooks according to some arrangement. But we, as information scientists, know the limitations of such notebooks as filing system. We have not come across anybody who stores his personal information in card form.

In fact, we feel that it is at these information centres and libraries that we have real opportunity to promote and popularise the discreet and fruitful use of documentation. This can be achieved in two ways: i) Firstly, by explaining to the user the method and use of our documentation system. ii) Secondly by encouraging the user in working out his own methods of storage and retrieval of information. The second way, gives the user the insight into the documentation system and it helps him not merely to have his own ways of information storage and retrieval, but also to understand the judicious use of our documentation. The method adopted by an average user in scanning, storing and retrieving the information of published and unpublished material relevant to him, and recording it, and retrieving it in a way which seems fit and useful to him for his future personal use, may be called as "PERSONAL DOCUMENTATION".

All the information centres and libraries generally adopt the first, namely acquainting the user with their documentation system. But they rarely encourage the user to work out his own way of documentation, which to us seems very important and vital. Therefore, instead of merely stressing importance of the documentation work done already at the information centres, it is strongly desirable to make the user cultivate the habit of doing his personal storage and retrieval of information.

This can be achieved in the following ways:

1. Recently some journals have introduced clipping service, the system of giving the abstracts of the articles printed on one side of the paper. These abstracts can be cut and pasted on cards. They are also provided with different subject headings.
2. Individuals can prepare the summaries of the articles in which they are interested on cards. In these days many journals provide the summaries of the articles either at the beginning or at the end.
3. Libraries and information centres can take initiative and prepare the cards on request.

As most of the scientific journals used here are published in foreign countries, very few individuals in India can afford to get personal copies of the journals. Information scientists can help them by distributing the cards with abstracts to the individuals interested in their personal storage.

WHO IS IN NEED OF PERSONAL INFORMATION STORAGE?

The scientists, technologists and physicians working in research institutions are in touch with information centres, and have to hunt for latest information and almost all of them know the use of abstracting journals and library filing systems etc. But what about the professionals? Physicians, engineers, technologists working in some establishments or practising privately, really are in need of this type of personal information storage system. These people have few hours, even minutes to spare for scanning new information and very little time to spare for the storage of the information which they have read and feel would be useful some time in near future. These people can directly utilize this information in practical use. Physicians can try on patients, engineers can try new methods and materials etc.

At present there are some journals which give the abstracts of the articles published in them. We can divide them in the following divisions:

1. Abstracts either at the beginning of the article or at the end of the article.

   Examples:

   1) American Review of Respiratory Diseases.
   2) Archives of Pathology.
   3) Australian Journal of Experimental Biology and Medical Science.
   4) Chemotherapia.

2. Abstracts given separately but not meant for cutting.

   Examples:

   1) Chemical Engineering Progress.
   2) Chemical Engineering
   3) Antibiotiki (Russian)

3. Abstracts specially meant for cutting and pasting on the cards.

   Examples:

   1) Annals of Internal Medicine.
   2) Acta Pharmacologica et Toxicologica.

We do not know when the mechanical aids like computers will be in practical use in Information centres. When they come into use they will perhaps be able to supply all the literature on a particular topic. But, even to select the pertinent information from the list supplied by the computer will be itself a difficult job. No doubt we are bound to take the help of such mechanical aids in the future. But we think that personal documentation will continue to be important.

EXPERIMENT

In our Information Centre, we attempt at exhaustive indexing and also storing of all the literature on 'ANTIBIOTICS'. We do not miss any literature on antibiotics. We cover books, annual reviews, yearbooks, periodicals, patents, standards, newspapers, theses and abstracting periodicals.

All the literature indexed is stored under suitable headings in card form. Any information relating to antibiotics, however old it may be, can be had immediately from our micro-index (guide to literature to antibiotics).

We mainly serve the scientists in our Research and Quality Control Laboratories which have the following sections:

1) Mycology;
2) Organic Chemistry;
3) Biochemistry;
4) Physical Chemistry;
5) Pharmacology; and
6) Microbiology.

We have tested this micro-index for many topics on antibiotics and we found it very accurate and exhaustive. Especially when a new project is being initiated, we prepare a bibliography on that topic. To test the exhaustiveness of our micro-index we checked the bibliographies with Chemical Abstracts, Biological Abstracts and Index Medicus. We found that our micro-index is more exhaustive than the above abstracting journals.

However, we found some of the scientists from our Research Laboratory jotting down the references and preparing the cards for hem. Sometimes we feared that our indexing may not be a useful one. We studied this problem by approaching many scientists who gularly jot down the references. In fact all the scientists who regularly jot down the references are regular users of our documentation services. We studied their references and found that the subjects they cover are not exactly relating to antibiotics, and also we found that their abstracting method is slightly different from the one practised by information centre. For example the following subjects are covered in personal documentation of some of our scientists:

1) Chromatography;
2) Electron microscopy; and
3) Anesthesia.

Information Centre also covers the above subjects, but only if they are related with antibiotics. We have observed that it is not possible for us to cover all the original work on the above subjects. If we start covering them we have to cover all the branches of sciences. We think that detailed coverage of such subjects is neither advisable nor practicable.

Therefore, we decided to study the problem of personal documentation and to know the relation between personal documentation and the documentation carried out by libraries and information centres.

We have selected one of our scientists from our Research Laboratory for our experiment. He is one of the most regular user of the library and also documentation services rendered by our Information Centre. In addition to the use of index-lists and abstract-list issued by Information Centre, he regularly scans the current periodicals and jots down the references which he feels would be useful to him in the near future. For any of his project work, relating to antibiotics he takes the full help of the stored and as well as current information services of the Information Centre. But he feels that there are some topics not exactly relating to antibiotics but still they are the topics in which he has to keep himself abreast of the latest developments.

We requested him to give his notebook in which he has jotted down the references. It contained 654 references for the period July 1966 to December 1967. We prepared cards for all the references. Some of the references were with summaries. We gave them the alternative subject headings. We gave him the complete freedom of arrangement of cards. Purposely we did not suggest him any type of classification schemes.

After carefully studying his notebook, we observed that:

1. Only 22% of the references dealt with antibiotics. (These references are also covered by our information centre and stored in micro-index).
2. 78% of the references dealt with methodology of pharmacological studies. (We do not consider such articles for indexing in our information centre).
3. Every week he finds 10-15 new references.
4. He has classified the cards prepared by us under following headings:

   Toxicity

   CVS - Cardio Vascular System

   CNS - Central Nervous System

   ANS - Autonomic Nervous System

   Chemotherapy

   Antibiotics

   Biochemical Pharmacology

   Clinical Pharmacology

   Review Articles

We asked him some questions and their answers are given below:

Q. 1 For how many years have you been jotting down such references in your notebook?

A. 1 Shortly after I registered for post-graduate studies in 1961.

Q. 2 How do you use your references?

A. 2 They are written in a notebook randomly and searched for at the time of need.

Q. 3 When do you use your references?

A. 3 At the time of planning certain experiments and new research projects and writing review articles.

Q. 4 Are you aware of the services rendered by our Information Centre in the following ways?

1. Recent Literature Bulletin. (a weekly index-list of important articles on all aspects of antibiotics).
2. Technical information Bulletin. (A weekly index-list of advance information of articles on antibiotics. This is issued at least one month earlier than the receipt of original journals. We take the references from 'Current Contents' which we receive by air-mail).
3. Patent Abstracts. (A monthly abstract list of patents on antibiotics).
4. Antibiotic literature Index. (Quarterly index-list of all the literature on antibiotics appearing in the Hindustan Antibiotics Bulletin).
5. Micro-Index to Antibiotics. (All the literature on antibiotics is indexed in card form. These cards are stored according to our own classification system. From 1949 onwards up-to-date).

A. 4 Yes, I know.

Q. 5 If you know (4) how and when you utilize them?

A. 5 While planning for new research projects.

Q. 6 What is the difference between your reference notebooks and index-lists issued by the library?

A. 6 Those supplied by the library are concerned with antibiotics only with little information on new methodology etc.

Q. 7 Do you feel any difficulty in searching your notebook for any required information?

A. 7 Yes. It takes quite some time.

Q. 8 What difference do you feel in card form index (which the library has prepared from your notebook) and your references in notebook?

A. 8 One gets the desired reference fairly quickly in card form

DISCUSSION

From the above answers, it may be noted that the personal documentation is supplementary to library documentation. Libraries and information centres attached to Research Institutions have to restrict their coverage to the main subject of the Institution. For example we cannot cover the following topics exhaustively.

Pharmacology,

Engineering,

Quality Control

No doubt, we cover, pharmacology, engineering and quality control etc., relating to antibiotics.

Another difference between personal documentation and library documentation is that the articles indexed in personal documentation are read by that person and then indexed by him.

FREEDOM OF STORAGE

As the cards stored by an individual are mainly meant for one's personal use only, type of arrangement should be left to him. Persons not working in the library are not supposed to know the sophisticated classification schemes. Even the existing schemes of classification do not provide the schedules for such depth topics. Almost all the libraries use their own methods for indexing and storage of indexed materials. We hope in near future mechanical aids like computers will be available for personal documentation also. Till then it is advisable to give freedom for the individual to use his own scheme of classification for storing.

NATURE OF ABSTRACTING OF INFORMATION

Example-1 Original author's summary appeared in the journal.	The effects of the methooxydopamines on the response of the central nervous system to stimulants and to the depressant action of hexobarbital are reported. The 3-methoxy, 4-methoxy and 3, 4-dimethoxy derivatives of dopamine caused augmentation of Metrazol and thiosemicarbazide induced seizures. Strychnine and electroshock seizures were not influenced by pretreatment of animals. The same dosage levels of the 4-

methoxy and 3, 4-dimethoxy derivatives which augmented the response to the stimulants produced a potentiation of hexobarbital sleeping time in 30% of the animals studied. These data would imply that the effects of these compounds on the central nervous system are complex. The locus of action of these compounds in augmenting the stimulant actions appear to be supraspinal.

Summary made by our scientist for his personal documentation.

Mice Metrozol 85 mg/kg I. P.

Thiosemi- 7. 5 mg/kg I. P.

Strychnine- 0. 65 mg/kg subcut.

Drug administered 15 min. prior to metrazol etc.

(Arch. int. Pharmacodyn. 1966. 164(2); 301-307)

Example 2.

Original author's summary appeared in the journal.

Some pharmacological properties of FC_{379} are described. The depression of the C. N. S. has been compared with that produced by meprobamate. Potentiation of barbiturate narcosis, spontaneous mobility, reduction of the muscular tone and anticonsulsive activity and effects on smooth muscles have also been examined.

Summary made by our scientist for his personal documentation.

Potentation of barbiturate narcosis., SMA, 'fall time' Anticonsulvant activity- Strychnine 2. 5 mg/kg I. P. in mice., cardizol-100mg/kg. I. P. in rats.

Diuresis-water force fed to rats three times at one hour intervals 50 ml/kg of water. Test subst. given after third admin. of water, amount of urine was measured at 30 min. interval for 3 hours.

(Arch. int. Pharmacodyn. 1966. 164(2); 340-344).

From the two examples shown above we can make out that the general summary is not so useful to personal documentation. He will abstract only that portion, some times even in keywords in which he is interested. Even the abstracts prepared by information centres will have a slant to particular group of scientists. Therefore, abstracting in personal documentation cannot be replaced by the published abstracts or the abstracts prepared by the information centres. But many people doing personal documentation have no time to abstract. In these cases original summaries or the abstracts prepared by information centres will be useful to individuals doing personal documentation.

CONCLUSION

From the above discussions, we may arrive at the following conclusions.

1. Personal documentation is more comprehensive.
2. Personal documentation differs from person to person and therefore no existing classification schemes will be useful to the persons doing it.
3. Librarians should make use of such personal documentation work for making the library documentation comprehensive.

It will be of much use for the librarians and information scientists to know the exact requirements of the individuals if they study the personal documentation. And we think to know the exact requirement is the basis for personal service and also for Selective Dissemination of Information (S. D. I.).

Persons doing personal documentation will definitely appreciate the library documentation in a better way. Librarians and information scientists should promote, wherever possible, personal documentation among their clientele. For detailed study we are also planning to conduct such survey on a wider scale in our laboratory.

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RESPONSIBILITIES OF AUTHORS, EDITORS, PUBLISHERS AND DOCUMENTALISTS IN QUICK TRANSFER OF INFORMATION

BALARAMA

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Indicates the vital necessity and importance of quick transfer of published information. Points out that this transmission is a chain-like procedure which has been aptly termed as 'Information Transfer Chain' by the President's Science Advisory Committee. Discusses the fundamental responsibilities of the various people involved in this chain. Examines the existing practices which ultimately hampers the speedy and effective communication of information. Suggests some feasible methods for effecting improvement in existing practices.

INTRODUCTION

A common practice adopted now-a-days in almost every article on documentation is to highlight the problem of literature explosion and to point out the inability of the scientist to keep himself uptodate with the current developments in his discipline. Whilst it is true that it is well nigh impossible to read everything that is published in one's field of activity, it is, nevertheless, essential to be aware of the latest developments and trends in the field; lest his knowledge would become obsolete and result in possibly mediocre efforts.

For the scientist, to be abreast of his times in his field of activity, he needs to be informed, most effectively. To do so calls for a system of information services that should provide the scientist with pertinent information as soon as it is available. The system, simple as it appears, involves at least four parties who bear the responsibilities for quick dissemination of information from the source to the user. The four parties are the Author, Editor, Publisher and Documentalist who form the connecting links in the information transfer chain.

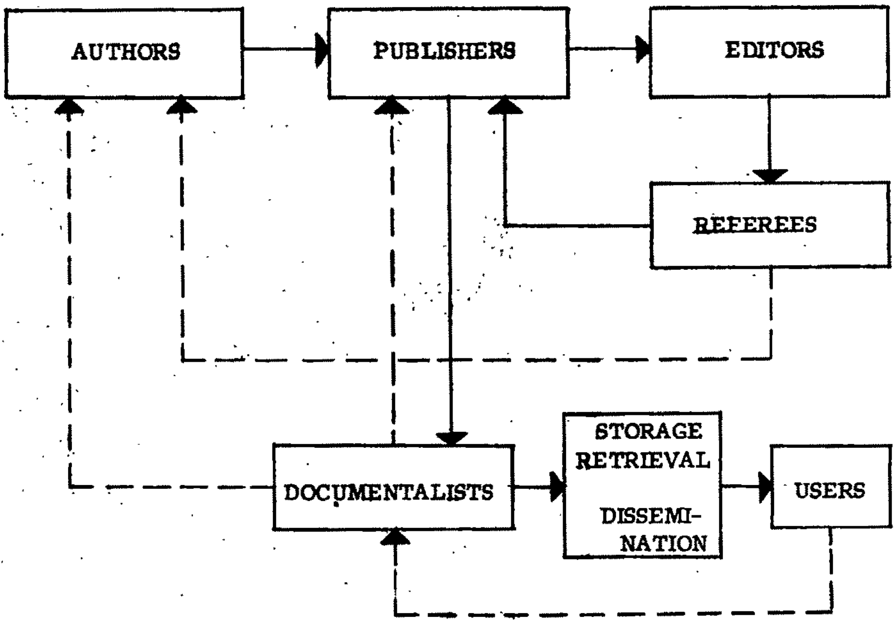
Before an analysis is made of the role and responsibilities of these four parties in the chain, it would be apt to quote Prof Derek J de Solla Price[1], who puts:-

> "It is probable that 80% of all scientific papers can be had from about 1000 periodicals and 80% of chemical papers would come from the biggest specialist journals, less than 100 in number, and even that better than 95% of the chemical literature could be had from less than 200 of the most eminent journals".

This clearly indicates that among the 50,000 scientific and technical periodicals, only 1000 periodicals cover 80% of useful literature. Therefore, literature explosion is not such a serious problem. The main indication in Prof Solla Price's statement is the enormous scope for selection. Therefore, if proper selection is made, the scientist will be able to read the selected literature in his field of specialisation, thereby greatly reducing the degree of obsolescence. The main problem of literature explosion is to bring pertinent published information to the notice of respective users within the shortest possible time. However, the required information is scattered in various types of publications and this has to be located, collected, stored, retrieved and disseminated, which, in essence is 'documentation'.

Several people are involved in the processing of information right from the creator of thought, the author, and the various agencies in between the author and the actual user. This entire information process is chainlike and has been aptly called 'Information Transfer Chain' in the President's Science Advisory Committee Report[2]. This chain which is shown diagramatically (see p.188) operates like a switching system.

The ultimate aim of this procedure is to connect the user to the proper information as quickly and effectively as possible. It, therefore, becomes apparent that people involved in this chain bear equal responsibilities for quicker dissemination of information.



INFORMATION TRANSFER CHAIN

1 RESPONSIBILITIES OF THE AUTHOR

Construction of Titles

The tendency of authors to give fancy titles to articles should be minimised, if not altogether stopped. The author should construct the title using 'meaty' words in the title so as to make it self-expressive. This practice is vital for many reasons. First, some abstracting and indexing periodicals like 'Chemical Titles' provide subject index through Keyword-in-Context and other Keyword indexing methods. Keywords are selected and permuted only from the title of the articles indexed. Second, the user comes across only the title of the article in indexing periodicals and bibliographical references which are supposed to aid his literature selection by revealing the thought content of the article for further study. Thus if the title is not self-expressive there is a great danger of missing the articles by the concerned user.

Preparation of Abstract

All the salient features of the article should be presented in the abstract. In some author abstracts it is found that the author claims several things while not all of them are actually to be found in the article. This practice greatly misleads the user. It is, therefore, essential that the author has to provide an indicative/informative abstract to the article for the following reasons:

(a) to assist the user in deciding whether or not he should read the original article; and

(b) to act as a substitute for the original article in case the original is not available.

One of the reasons for the inadequacies in author abstracts is that authors are not trained in the techniques of preparing abstracts. These shortcomings in the content of the abstract thus stand against their direct inclusion in national and international abstracting periodicals. In an endeavour to facilitate better abstracting, Unesco initiated and sponsored an international conference on Science Abstracting in 1949. An important outcome of the Conference was the publication of a guide for the preparation of synopses [3]. Some of the important rules from 'Guide for the preparation and publication of synopses' are:

(a) Synopses should comprise a brief and factual summary of the content and conclusions of the paper. It should enable the busy reader to decide more surely than he can from the mere title of the paper whether it merits his reading;

(b) Synopses should be intelligible in itself without reference to the paper;

(c) Synopses should, only in exceptional cases, exceed 200 words.

At present there is six months to one year time lag in reporting published information in abstracting periodicals. Several reasons such as inadequacies in author abstracts cause this delay. If the authors practice all the rules of the guide, the time lag could be appreciably reduced.

Presentation of the Article

The effective communication of the thought content of the article to a great extent depends upon the method of its presentation. Therefore, the author should lay great emphasis on the manner in which the article is presented. The author should make a clear demarcation between the various parts of the article such as introduction and text (text could be further divided into different subheadings), Summary, Conclusions, Bibliographical References, Appendix, and arrange them in a logical sequence. Interspersing the article with diagrams, charts or tables will enhance understanding of the article.

To bring all articles to conform to some standard mode of presentation, the International Organisation for Standardisation (ISO) brought out its recommendations which could be modified according to local conditions and needs. If the ISO recommendations are practiced, communication of information at international level could be streamlined.

Bibliographical Citations and their Presentation

In the field of research, fundamental or applied, new developments and innovations are generally the result of existing knowledge in that particular area. This clearly indicates that existing knowledge facilitates the formulation of new thoughts or helps lead to new developments. It is, therefore, necessary that in all articles wherein already recorded information has been used, the references to those should be given mainly to show the association of ideas between his and past literature. Citation of recorded information is also necessary for the following reasons:

(a) to provide a list of relevant documents on the subject concerned for further study;

(b) to show the authenticity of any statement that has been made in the text;

(c) to acknowledge the sources consulted and to show that listed items have been used as source documents.

From these reasons it will be observed that each cited bibliographical references (BR) carries a message. It is therefore necessary that citations should be communicated clearly. But normally authors are instructed to cite BR according to publishers' pattern. Authors are often required to restrict information in BR to a minimum because of space limitations in the periodical. To counter these difficulties several plans, have been suggested, particularly by McCasland, Reid (Sigil System) and Charles Bishop (Coden System). All these plans formulated a code with information such as Title (host periodical), volume and page number in its extreme abbreviated form.

These plans were criticised by Dr. Boaz, who pointed out that a single printing mistake would mean a total loss of information. Also, these plans violate the basic tenets of citing BR.

Therefore each cited BR should be complete in itself. But presently there is no uniform practice followed in citing BR. Some journals provide author and locus while in some only locus is given. Authors and periodicals who provide incomplete information regarding BR are defeating the very purpose of BR, since the principle function of BR is to provide a list of relevant documents which could be profitably used by the user to select documents useful from his point of view. Further, if complete information in a BR such as author, title, locus, inclusive pagination is provided, it not only helps the user in selection but also gives an idea of cost involved for its procurement, if it is not available locally.

ISO soon took up this problem and formulated recommendations which were issued as ISO/R77 which were later adopted by British Standards and Indian Standards in their publications BS 1629/1959 and IS 3281/1963 respectively.

In this context cooperation between the publishers and authors is of utmost importance. Authors, unfortunately, are bound by the practice followed by the periodical to which they submit their papers for publication. It is, therefore, necessary that publishers change their practice, if cited BR have to be purposeful, and the best means is for publishers and authors to follow the recommendations given in 'Bibliographical References' (ISO/R77).

The recent exploitation of the BR emphasizes the extreme importance of quoting references - these are Bibliographic Coupling and Citation Index. Bibliographic Coupling which was developed by MM Kessler [4], is an objective study of finding out the relation between two or more papers on the basis of their bibliographic citations in common. The utility of this study is to find out the possibility of listing all the articles together on the basis of their coupling strength which reveals the relevancy of the thought content or association of ideas. Citation index, which is part of 'Science Citation Index' developed by Eugene Garfield[5] is a kind of subject index in a new dimension, to the selected sources of literature. It is an ordered list of cited articles each of which is accompanied by a list of citing articles.

Abbreviation of Titles of Periodicals

The titles of periodicals form an important part in bibliographical citations. The Standards for BR recommend abbreviation of the title of the periodical. The main object of abbreviating the title is to save some linear space. It is also argued that the primary purpose of abbreviation is economic from the point-of-view of scientists and that it saves time and effort of the user. However, the authors can take full advantage of the recommedations made by different standards to abbreviate the title of the periodical, but the abbreviations thus made should be self-evident and be easily decodified by the users.

So far several standards to facilitate a uniform code of practice to abbreviate titles have been published. Notable of these are the IS/18 and ISO/R4. Besides, American Chemical Society and World List of Scientific Periodicals (WLSP) have formulated their own standards. In fact ISO recommendations are based on WLSP practice. ISO has also suggested to various countries to modify ISO/R4 to suit their own requirements. With the availability of these standards, authors should follow any of these and in this context, cooperation of publishers is very much required. Publishers, instead of establishing their own method of abbreviation, should adopt any one of these standards. This will greatly avoid confusion and difficulties to everyone involved in the 'Information Transfer Chain'.

Listing Bibliographical References

There is no uniform practice followed in the order of listing BR. Some periodicals list author's surnames in alphabetical order, while others list chronologically. The former method serves little purpose. The useful order would be the one wherein items of the BR are referred to in the text. Each referred item may be numbered serially and then arranged accordingly at the end of the article. As far as possible, citing BR as a footnote or within the text of the article should be minimised, if not avoided altogether. It will be more useful if all citations are consolidated together and given at the end of the article.

'Keywords' for the article

It will be observed that the author cannot use all the keywords pertinent to the article in the title. But it will be useful if authors supply all important keywords apart from those used in the title. This will be particularly useful in providing subject index to the article. In order to quickly prepare subject index and to provide all possible approaches to the user, authors should choose keyterms from the standard subject headings or Thesaurii. AIEE, AIChеE and WRU have brought out thesaurus in the field of Engineering, Chemical Engineering, and Metallurgy respectively.

Implementation of the 'Code'

A liaison Committee was set up by FID/ICSU/IFLA/ISO/UNESCO to study and devise international measures to improve the present position regarding scientific information and its publication. The committee observed that absence of universally accepted discipline for drafting and publishing scientific information was one of the reasons that caused unnecessary additions to the volume of documents published and to the expenditure involved in printing, abstracting, listing and locating them.

According to proposals made by the International Council for Scientific Union (ICSU) Abstracting Board, the Liaison Committee issued a code entitled 'Code for Good Practice for Scientific Publications [6, 7]. The rules laid down in this code should be obviously morally binding on every author of scientific publication and its editor. The vital importance of adopting uniform international standard in documentary scientific information is emphasized. The standard which is applicable universally will make it possible to arrive at a single method of drafting author's summaries, a single code for abbreviating periodical titles, a single code for BR citations and a single code for transliteration of characters of one alphabet into those of others.

The 'Code for Good Practice' has been published by Unesco with the conviction that observance of the rules of the code will enhance the value of the information contained therein and reduce the enormous expenditure incurred by scientific and technical documentation centres of all countries. Some of the important rules of this code are that:

a) All original texts shall be accompanied by an abstract, to be compiled by the author himself.

b) Abstracts shall be drawn up in conformity with the 'Guide for the preparation of synopses' (Unesco document NS/37D 10a).

c) The category of the paper should be specified as stated below:

   1. an original scientific paper;
   2. a short communication; and
   3. a subject review article.

d) The text shall fully describe the methods employed and significant results obtained.

e) Explicit reference shall be made to any work previously published in order to evaluate how the presented text fits into the general picture of scientific progress.

f) The international rules governing the abbreviations of titles of periodicals, the order of bibliographical references, symbols and abbreviations, transliteration, terminology and the layout of articles should be followed.

2 RESPONSIBILITIES OF EDITORS & PUBLISHERS

Non-self-expressive Titles

Publishers should reject, if they find the title of the article is not revealing the thought content of the document or should ask the author to retitle it. Also, the responsibility of publishers is to see that the article is carrying synopsis and bibliographical references. Although, it is the responsibility of the editors and referees to ascertain the quality of the synopsis and adequacy of bibliographical citations, the publishers at any cost, should not accept articles for publication which carry no synopsis.

Sub Standard Articles

Publishers should not approve the articles which are sub-standard. This is one of the ways of controlling the exponential growth of literature. This point has been clearly brought out in the Unesco document 'Code for good practice'. Also, the Presidents' Science Advisory Committee suggested to the authors to refrain from unnecessary publication. The Committee felt that the inadequate means of switching between information systems is one of the causes for redundant publications. If the switching device - title announcements, abstracts, referral services - were fast and efficient, the redundancy could be eliminated. However, the publishers with strict editorial policy should establish good standards and any contribution below that standard should be discouraged.

Page-proof Articles to Secondary Publications

The responsibility of publishers is to send the page-proof copies of articles to the abstracting and indexing periodicals, so that the time delay between the publication of the original articles in the primary periodicals and its inclusion in the abstracting and indexing periodicals will be minimised. This is the actual recommendation made by the International Council for Scientific Union (ICSU) Abstracting Board.

Announcement of Accepted Articles

The publishers should announce in periodicals, the article accepted for publication in the subsequent issue. This is most desirable as there is a considerable amount of delay in the publication of articles. If the publishers follow the above said practice, it can definitely provide manifold advantages such as creating current awareness, minimising duplications etc.

RESPONSIBILITIES OF EDITORS

Synopses

Synopses (also called homotopic abstract) is a term adopted by the Royal Society of London and by the Unesco International Conference on Science Abstracting, 1949, to describe an authors' summary of a scientific paper which is published simultaneously with the paper itself, after editorial scrutiny. As has already been indicated, that the authors are not trained in the techniques of abstracting and also they view the article from their personal angle. This necessitates the editor to delete or supplement information and publish it under his responsibility.

Bibliographical References

This is the most important item and the basic purpose of this has already been indicated. Editors must ensure that it fulfils the basic purpose and check each cited item for its correctness and adequacy. Normally, the citing author commits mistakes in giving Volume Number, Issue Number, Date of Publication and some times the title of the host periodical itself. All these items are to be checked carefully and corrected if necessary.

Order of Listing Including Mode of Citation

Editors have to check the order of listing of bibliographical references including its mode of citation. As has already been indicated, alphabetization according to surnames of the authors serve little purpose. Hence the recommended method has to be strictly followed.

Reformation of Contents Page

Processing of technical information can befurther quickened, if editors and publishers reform the contents page. The existing practices with regard to providing information in the contents page vary widely and there is no uniform practice. Contents page is an important part in a periodical for the documentalist so far as the current awareness service is considered. The current awareness service will be most effective only when the contents page is complete in itself. Therefore, the role to be played by editors and publishers in reformation of the contents page is vital and they have to consider the following items for incorporation in the contents page, if not already being done.

(a) Title of the periodical;

(b) Volume Number, Issue Number, Date of Publication;

(c) Inclusive pagination for each aritcle;

(d) Dividing the contents page into broad subject headings.

Some of the periodicals do not indicate the title of the periodical on the contents page. This is a great handicap, since some documentation centres at local level or national level are bringing out 'current awareness list' by just procuring contents pages in advance. If the contents page is not indicating the title of the periodical, then the documentation centres have to procure the title page also to identify the contents page.

Or, according to the recommendations made by the International Conference on Science Abstracting sponsored by Unesco, if the synopses of all the articles appearing in a single issue are printed together either inside the cover or with advertisements on the back in such a way that it can be cut without mutilating the pages of the journal, then it can be easily detached and circulated among scientists. Apart from these, if the contents page is divided according to broad subject headings, it will be further useful in scanning through the contents quickly.

Some journals are providing classification numbers at the top of respective articles and almost all periodicals provide synopses. If editors and publishers could provide these details in the contents page itself (which they can do without wastage of space as it will be only change of place), it would be most useful for the documentalist as he can bring out current awareness list in a classified form with abstracts within the shortest possible time.

Some current awareness services like 'Current Contents', are providing author directory with the intention of establishing contact between the author and the user. This work can be quickened if the author's address is also provided in the contents page.

Location of Contents Page

There is no fixed place for the contents page in a periodical. Some publishers print the contents on front cover, while others on the recto of back cover. But providing the contents page in this manner, especially on the front cover may cause difficulty in getting good photoduplicated copy for the purpose of current awareness service. This is due to colour contrast. Therefore, it is always better to provide contents page in a separate sheet inside the periodical with all the required details.

3 RESPONSIBILITIES OF THE DOCUMENTALIST

Creating Current Awareness

The documentalist shares greatest responsibility in the quick dissemination of information, or, o to speak, in switching information between the author and the user. In fact, the documentalist has to create the current awareness in the concerned field among the scientists. He has to constantly study the requirements of his clientele and as soon as the required information is published, it should be brought to the notice of the respective users within the shortest possible time.

This can be accomplished, by procuring the advanced contents page of the relevant periodicals as soon as they are published and circulating it in the form of photo copies or mimeograph. These services which are project-oriented services and are also termed as Selective Dissemination Service at local level. At local service library, reprographic equipment is not held as they are very expensive and also they will not be in a position to procure advance contents page by air mail. In such cases, the current awareness service has to be rendered as soon as the periodicals are received in the library. The contents page of important periodicals could be typed, omitting puffs if any, in the alphabetical order by the title of the periodical and quickly circulated in the mimeographed form.

The current awareness list can take any form such as, contents-by-journal, arrangement of title under broad subject heading (e.g. Index Medicus) etc. Quickness is the essence of such services. The current awareness list based on contents-by-journal type is found to be the quickest method in bringing the published information to the notice of the potential user. Any attempt at classifying articles and providing feature headings including supporting indexes hampers the speedy dissemination of information. Delay is caused by attempting to provide a comprehensive coverage. In fact, the current awareness service is a kind of temporary palliative for the user before he gets a comprehensive coverage of the items in a classified form. This point has been brought out by Mr PL Broadhurst[8] and he called it as one of the 'public palliatives'. The author actually recommended three public palliatives for the scientist which are, current awareness service, KWIC indexing and Citation indexing.

Circulation of Periodicals

Some of the local service libraries forward the current issues of the periodicals itself to the scientist for current awareness purpose. There are several methods existing at present for routing of periodicals such as circular routing, radial routing etc. There are several drawbacks in such practices. For example, in circular routing, the periodical may be stuck up at one place and all the time the documentalist should be constantly vigilant and see that the periodicals are moving. In the case of radial routing also, the documentalist has to be vigilant and get back the periodicals and pass it on to the next user. In both these practices the time required is considerable and by the time the periodical reaches the last user, the currentness of periodicals themselves may be lost. The appropriate method would be to circulate a few copies of the contents page.

Pursuing Editors and Publishers

The documentalist should pursue the editors and publishers to facilitate speedy dissemination of information it is felt that existing practices work at cross-purposes. Editors and publishers must be made to follow the code regarding the following particulars of an article.

(a) Presentation of articles;

(b) Contents pages (including its occurrence in the periodical);

(c) Titles of the articles;

(d) Synopses;

(e) Bibliographical references, its order of citation and the mode of citation; and

(f) Place of occurrence of bibliographical references.

4 CONCLUSION

Thus, if all the responsibilities of the various groups are carried out properly, the time lag prevailing in bringing the published information to the notice of potential users can be minimized, though not completely eliminated. Also, the effective utilization of published information can remarkably be enhanced. This undoubtedly eliminates duplication and stimulates further research which ultimately facilitates in bringing the economic growth of the country.

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REPROGRAPHY IN INDIA — A STATUS REPORT

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Surveys the reprographic facilities available in India. The role of Insdoc and a few other organisations in providing such facilities for the benefit of science is highlighted. It is pointed out that in some cases lack of proper advice on the choice of equipment to suit the exact needs has resulted in inadequate use of even limited facilities. Recent progress in the indigenous production of equipment and materials is also taken stock of. Some suggestions are made regarding training of technicians in reprography and standardization of reprographic matters.

As in several fields of industrial progress and technical advancement, in the field of reprography also India is waking up. Until about 10 years back there was not even a keen awareness of the potentialities of and the need for reprographic techniques and applications, in the vast fabric of academic, industrial and economic life in the country. Of course, there have been significant exceptions, where some institutions, mostly under governmental auspices, have been making extensive use of reprography. Examples are the Insdoc (Indian National Scientific Documentation Centre) under the Council of Scientific & Industrial Research and the National Archives of India, under the Ministry of Education. What follows is a rather sketchy history of the development of reprography in India.

Recent History of Reprography in India

Governmental involvement with reprography has been in connection with the following activities/departments: Archives, scientific documentation, registration of title deeds, financial audit, tourist traffic, census operations, public sector industries, etc.

Government organisations

One of our earliest government departments to use reprography was the Photo Registry of the Government of Bombay (now the State Government of Maharashtra, after the linguistic re-organisation of the States of India) located at Poona. For some decades now this department has been concerned with the photographic reproduction of title deeds and other legal documents vouching for ownership and transfer of landed property, buildings and other real estates within the State of Maharashtra. This service is somewhat unique, as no other state government in India appears to have set up a regular photographic reproduction service as an adjunct to the department dealing with the registration of documents. An old Photostat machine is still going strong at Poona rendering useful service to sellers and buyers of property and litigants.

In some of the states (for example the State of Bihar, at its capital in Patna), the Accountant General's Office has got a photographic facility to provide copies of official documents and to assist in the records management in the area of auditing and fiscal control of governmental expenditure.

Perhaps the oldest organized reprographic set up under the auspices of the Government of India, is in the National Archives of India, under the Union Ministry of Education. No other organization, governmental or private, has reached the volume of microfilming work that is being handled in the National Archives. The National Archives of India has a continuous programme of micro-recording. This unit with a battery of Recordak cameras and ancillary equipment and a team of trained technicians can look forward to decades of useful service; the National Archives have yet to put on microfilm a vast portion of the state records of this century, particularly a great bulk of documents that have been created after independence.

The Ministry of Commerce and Industry had, until the early 50's, what was called the 'Administrative Intelligence Room'. This unit had both Photostat and microfilming equipment to provide reprographic facilities mainly to the parent Ministry and also to other government departments at New Delhi. This unit has since been disbanded with the equipment getting relocated, partly with the Photo Litho wing of the Government of India Press and partly with the National Archives.

The Department of Tourism installed around 1959, diffusion-transfer type of processors with contact reflex copiers at major ports of entry for copying of tourist cards containing data on incoming foreign tourists to India.

Role of Insdoc, New Delhi

It was not until 1952 that an organised and well equipped reprographic service, accessible to a wide range of clientele, came to be established as part of the activities of the Indian National Scientific Documentation Centre (Insdoc), Insdoc was set up as an unit under the Council of Scientific & Industrial Research, in New Delhi, with generous assistance from UNESCO, under an agreement between that international body and the Government of India. The assistance took the form of gift of a range of reprographic equipment; the services of experts in scientific documentation, reprography and translation; and fellowships to some of the Indian staff members of the Insdoc. This writer was the recipient of one of the UNESCO fellowships, and he had the opportunity to visit the USA and Europe during 1954-55 to study the reprographic techniques then prevalent in the advanced countries. With a team of technicians, many of whom had some previous experience of technical photographic work and who were given the proper orientation and training on reprographic techniques, the services of Insdoc gained momentum during the 1950's.

The equipment obtained from UNESCO comprised:

1 Lectra-II microfilming camera, manufactured by Tokyo Micro-Photo Works, Japan.

2 Leitz Reprovit-I, made in Germany.

3 Lumoprint - rewind type motorized film developing unit, made in Germany.

4 Microtronics - positive film printer, made in USA.

5 Copycat, large format vacuum contact printer, made in UK.

6 Contoura, portable contact printer with an air cushion, accessory for ensuring good contact with small bound volumes, made in USA.

7 Develop (Dr Eisbein), developing unit for diffusion transfer materials, made in Germany.

8 Reading devices for micro-records:
   a) Thomson-Houston brand with built-in opaque screen, made in France.
   b) Microvist - portable reader (with collapsible arms for the projection mirror), made in Germany.
   c) Kangaroo reader, made in France.
   d) Microcard reader - for reading, by episcopic projection, opaque micro-cards, made in USA.

9 Enlarger with point-source lamp by SFMD, made in France.

10 Azoflex K-10 diazo printer, made by Ilford Limited, UK.

11 Hunter-Penrose process camera, made in UK, along with infra-red film-drying cabinets.

12-14 Rotaprint offset printing machine made in UK, along with ancillary equipment for plate-making and plate-exposing.

The above basic equipment has been supplemented, from time to time, with other gadgets, which include: a Rolleiflex, a Leica M-3 with a battery of lenses, a second Reprovit unit (Model IIb), a Recordak Microfilm camera model AH-5, Recordak projection printer Model B with point-source illumination, an Ilford strip film printer (for making diapositives of individual diagrams and technical illustrations) and four more offset printing machines (one Zetaprinton and three Romayors, all made in Czechoslovakia).

With this array of equipment collected, under one roof, it was possible to render reprographic services (mainly of scientific documents) to the scientific, technical, engineering and medical communities, for the first time in India. During the past 15 years the services have grown tremendously. Though in the early stages a majority of the clientele were from academic and research institutions, in recent times a number of industries and business houses have started making regular use of the reprographic services of Insdoc. The bulk of the services comprises furnishing of readable photocopies on paper (hard copies) closely followed by microfilms in strip form. Papers from scientific and technical articles published in a plethora of periodicals comprise the bulk of the requests; patents and standards (national, foreign and international) and theses submitted for award of higher degrees of major universities in and outside India are also being serviced.

Besides furnishing of copies of specific scientific documents demanded by clients, Insdoc also undertakes to produce various kinds of reprographic versions of documents brought in by clients. A few of these may be reprints or the author's copies of original papers but a majority of requests are for the reproduction of meta-documents, presenting a wide variety of problems which are challenging to the skill, experience and ingenuity of the reprographic personnel.

a) Either magnification or minification of illustrations to produce dimensional variants, are required, mainly for sending along with papers for publication or inclusion in theses;

b) production of intermediate masters for further reproduction by diazo or other means;

c) unitized microfilms of line- and half-tone illustrations and positive transparencies therefrom, meant for projection as visual aids during lectures, seminars and conferences;

d) multiple reproductions either by diazo or offset-printing of technical brochures, instruction manuals or scientific or other data for distribution and dissemination;

e) positive version on 35 mm film of continuous lenghts of micro-film negatives, for use as substitutes for out-of-print back volumes of scientific journals (e. g. the Journal of the Indian Botanical Society was reproduced by Insdoc to make available, to new subscribers, through the Society, positive microfilm editions of back volumes of the journal of that society);

f) special high quality reproductions by contact printing of high contrast negatives on lith-type film obtained on a process camera of complicated diagrams, having a wealth of detail, for inclusion in bio-medical dissertations.

The above types of reprographic work give a broad cross-section of the variety of work demanded of and met by Insdoc's services.

Insdoc Centre, Bangalore

In 1964 a regional offshoot of Insdoc was set up in collaboration with, and in the campus of the Indian Institute of Science, a 60-year-old premier institution of advanced scientific learning and research in India. The decision to establish this Centre was part of a plan to set up three or four such units in different regions of the country to supplement the services being provided from the main centre at New Delhi. The choice of locations was to be guided by the availability of rich collections of scientific literature, mainly periodicals, spanning a range of disciplines, languages and countries of origin as well as the depth or extent of collections going back to several years. UNESCO once again provided technical aid for furnishing the Bangalore Centre of Insdoc with reprographic equipment. With the experience gained during more than a decade of active and useful service at New Delhi it was possible to make a choice of reprographic equipment based on recent developments and improvements in the field.

The equipment at Bangalore includes:

a) Durst M-35 enlargers (two pieces, made in Italy).
b) Leitz Reprovit, model-IIa (made in Germany).
c) Microbox MB2EBW microfilm cameras (two pieces, made in Germany), one piece to be shifted to Insdoc, New Delhi, for use in a mobile microfilming unit.
d) Fotoclark Printaphot pneumatic contact copying apparatus (made in Germany).
e) Copyclark book copier with diffusion transfer developing unit (made in Germany).

f) Recordak microfilm reader MPE (two pieces, made in USA).
g) Johnson's Supergloss Dryer made in UK.
h) Autofax electrofax-type book copier (using zinc oxide coated paper, made by Toshiba, in Japan).
i) Positive film printer for printing of 16/35 mm rolls of microfilms, made in Japan.
j) Lumoprint Zindler rewind type developing unit (two pieces, made in Germany).
k) Pako Rotary print washer (made in USA)
l) Copyspeed vertical process camera with Xerox attachment.
m) Hunter-Penrose-Littlejohn Offset Plate-Coating Whirler and 3-way printing down frame.

Routine services

With the above complement of equipment and 3 Romayor offset printers acquired with internal resources, reprographic services commenced from the third quarter of 1964. It has gained considerable momentum during the past three years. Among the clientele of the Bangalore Centre of Insdoc are several industrial and academic organizations, not necessarily confined to the South. Many of them have become aware of the richness of the collection of scientific literature, spanning a wide range of subjects, readily accessible to this Centre at its host institution - the Indian Institute of Science - and other special libraries in the Bangalore area.

The offset printing sections at both Delhi and Bangalore are being used mainly for producing the internal publications for documentation work namely, the Indian Science Abstracts, Annals of Library Science & Documentation, the series of Union Catalogues of Scientific Periodicals in Indian libraries etc. As a special case, some special publications of outside organisations have been undertaken for the Indian Institute of Science, the Commonwealth Institute of Biological Control, the Radio Research Committee of the CSIR, the Indian Agricultural Research Institute, etc.

The reprographic services of Insdoc both at Delhi and at Bangalore have brought in their wake an increased realization of the potentialities of reprographic tools, particularly in the context of creative scientific writing and publication. Creation of original documents, with due regard to quality, uniformity and clarity of illustrations with a view to their eventual reproduction (either magnified or minified, in one or two copies or in tens or even hundreds) seems to be done now with greater care and diligence than before. The advice of Insdoc is often sought before illustrations are prepared for conferences, for theses and publications.

Since 1958 the Indian Association of Special Libraries and Information Centres (IASLIC) has been rendering useful service from Calcutta by furnishing microfilms and photocopies, especially of material accessible to them in the various scientific libraries in the Calcutta area. They make use of the premises and part of the facilities available in the library of the Geological Survey of India. The growth of IASLIC's reprographic services is remarkable. From about 20,000 pages on microfilms and 1,300 pages as photocopies supplied in 1958, the figures for 1966 came to around 70,000 pages on microfilm and 3,000 pages as photocopy.

Indian Statistical Institute

This Institute, which is also at Calcutta, is very well equipped in its reprographic facilities. Having the status of an university, it has got a remarkable collection of scientific literature in statistics (pure and applied), mathematics, econometrics and allied disciplines. ISI also extends reprographic services to outside organizations, including Insdoc, though primarily it has been set up to cater to internal needs. ISI has got microfilming equipment, readers for ribbon microfilm and sheet microfilm (microfiche) as well as for opaque microcards. They are reported to have ordered for a Xerox equipment, which is to be installed shortly.

Atomic Energy Establishment

Indian contribution to the peaceful uses of atomic energy has gained world-wide reputation. The Department of Atomic Energy of the Government of India has its major research and development facilities in the Bhabha Atomic Research Centre, recently re-named in honour of Homi J. Bhabha, the illustrious scientist. Mainly to meet the internal demands for scientific documents from more than 2,500 of their scientists working mostly in the Bombay area and also in other centres in the country, the BARC has got an excellent array of equipment: Xerox 1385 Master-Maker, Xerox 1824 Universal Enlarger Printer, Remington Rand Photo Copier, Kodograph Micro-print Reader, Recordak Microfilm Readers, Ross Universal Micro-Reader, Multilith 1250 offset printer and other related accessories. They have planned to instal several readers and reader-printers to enable extensive use of microfilms and microfiche as, in these versions, large quantities of current research reports on atomic energy are acquired from various foreign countries, particularly from the USA and through the International Atomic Energy Agency at Vienna.

Some university libraries have equipped themselves with some basic reprographic equipment, to serve their own research departments and also outside parties who demand copies of scientific material in the collections of the libraries in these universities. As an example, can be cited the MULDOS (Madras University Library Documentation Service), which has a simple contact printer, an enlarger and a small capacity microfilming camera. Several more universities are in the process of setting up reprographic units attached to their libraries. Many universities seem to be content now with having just a microfilm reader in their library.

Special reprographic problems vis-a-vis scarcities

Sometimes some special reproduction problems are brought in to Insdoc. Though many of these are generally of such a nature that they can be handled with existing facilities at Insdoc, the paucity of specialised reprographic materials, due to severe import restrictions have obliged Insdoc not to be as helpful to some clients as we would like to. This is especially distressing since the technical know how and competence are available but lack of proper materials is the main problem.

Internal Reprography Services in Industrial Enterprises

In recent years there has been a growing recognition of the need to instal reprographic service systems to aid efficient management of administrative and technical records in industrial houses. The advantages that reprography offers in increasing productivity and by minimizing time, effort and cost of paper work is being slowly recognised; but the awareness is yet to come to a very large number of potential users and beneficiaries of reprography. This may be due to the absence of a central national agency or a society interested in the popularisation of reprographic techniques and in the propagation of news about its developments and its applications, elsewhere.

Even the few industrial units that have installed reprographic sections do not seem to have been guided impartially on the proper choice of the systems and equipment. Often, the decision to acquire a specific type of equipment is taken on the basis of advice tendered by an engineer or an executive from a foreign collaborating industry or on the basis of a recommendation by an Indian engineer or executive who has (perhaps casually) seen one of the marvellous reprographic gadgets in a foreign country. This is not to say that the installations of reprographic units in the few industries in India that have them, are all incorrect. On the contrary, such installations have helped to make more people aware of the advantages of reprography, even though the economic viability of a particular reprographic installation, or the process and equipment chosen, may be open to question.

As examples, may be cited:

The Xerox model 1824 installed at the Hindustan Machine Tools Factory at Kalamassery, Kerala, and the Xerox 1318 unit (basically, a process-camera type of design, built by Messrs. Hunter-Penrose Littlejohn, of England), with a xerographic adapter, installed at the headquarters factory of the HMT at Bangalore. The Xerox 1824 unit is capable of taking microfilmed records (either as in rolls or as strips or as individual frames mounted in aperture cards) and has the ability to reproduce enlarged versions on ordinary paper as a xerographic powder image. The spare capacity of their microfilming and Xerox reproduction facilities are available to outside parties, on payment.

One of the important ordnance factories engaged in defence production is reportedly going in for the installation of one Kontophot equipment (distributed by Agfa-Gevaert India Ltd) which is an unique combination of a process camera, a photostat camera and a microfilming camera. The installation is yet to be commissioned in this factory, but it is expected to meet a wide range of reprographic requirements.

The Bharat Heavy Electricals in their two plants at Hyderabad (one for heavy power equipment and another for switch-gear) are also installing microfilming and re-enlarging equipment, and an offset printing unit to meet their internal needs. A sister unit called the Heavy Electricals Limited at Bhopal also has a well-equipped internal reprography unit.

The above are only stray examples to indicate the current interest evinced by top managements of various industries in the public sector. In privately-owned industries also interest in reprographic systems is evident. For instance, the Tata Iron and Steel Company at Jamshedpur recently advertised for an executive at a fairly high level for the management of their reprographic installation. One of the foreign oil companies is reported to have acquired a Xerox unit at Bombay or Calcutta. These instances are, however, only few and far between. There are still a very large number of industrial units who are either not aware or cannot find the financial resources to instal their own reprographic units and to derive the benefit therefrom.

In several cases, particularly of academic and research institutions, some reprographic installations have been set up with foreign aid. In many of these institutions also, the lack of proper advice on the choice of equipment, to suit the exact needs of the organisations, has resulted in inadequate use (or, even abandonment) of the installation. The main difficulty in such cases appears to be the continual recurring need for sensitive materials, chemicals and spare parts which have to be imported in the unhelpful climate of import restrictions and foreign exchange shortage. At the time of selecting the equipment, adequate attention does not appear to have been given by many of the Indian executives and their foreign advisers to this point.

The Indian Council of World Affairs at New Delhi obtained through the Ford (or Rockefeller) Foundation, a Verifax Signet Copier made by Eastman Kodak, U.S.A.; only after installing the unit did the concerned authorities wake up to the fact that they needed supplies of the special matrix paper and the specially treated, though non-sensitive, image receiving paper, for keeping the unit in use. Due to import restrictions it was practically impossible to ensure regular supplies of these materials as well as the activator-chemical.

The Indian Agricultural Research Institute, New Delhi, had acquired through one of the foreign aid programmes, a 'Filmac-100' reader-printer (made by the 3M Company in U.S.A.). This is a very convenient apparatus for instant reproduction of readable hard copies from microfilmed images, which can be obtained selectively and quickly at the push of a button. The IARI has managed to obtain a fairly large supply of rolls of the special paper (having a thin aluminium foil laminated to the paper base) as required by the process of photo-conductography employed in this unit. To ensure a regular supply of this special type of material, which is made only in the USA, will be a problem.

Availability of Imported Reprographic Equipment and Materials

Until a few years ago even the common photographic materials were not produced in India and were available only through imports. In the early 1950's, before the import restrictions were tightened, sporadic imports were made of microfilming cameras and processing and reading equipment; contact copiers (with diffusion transfer processing gear), and diazo printers. Photostat, Statfile, Copycat, Banda, Azoflex etc were some of the brand names imported from the UK; Duplomat (Dr Boger's), Lumoprint, Fotoclark (Freidrich Grun), Leitz Reprovit and Zeiss Dokumator came in from Germany (West and East) and Recordak, Verifax, Photostat, 3M and Remington Rand's Transcopy from the USA were among the chief brand names that were imported, though on a small scale. Excepting the DTR processors and contact printers, most of the other units were only imported after firm orders had been secured by the distributors. Indian market conditions were not ripe enough for the import of, or dealer in, reprographic hardware to gamble on investing capital and on exhibiting expensive and precision equipment on the slender chance of some future orders. A number of commercial firms evinced interest and some of them installed some kind of equipment as an office copying device. In many cases again, the choice of equipment cannot be said to have been based on full knowledge and enlightened judgement; it was more a credit to the salesman of a particular importing firm to have secured the order for a particular piece of equipment or process, by the buyer.

In the late 1950's when interest in reprography appeared to take on momentum and there appeared to be a potentially large demand for reprographic systems in India, the economic ills of the nation compelled the government to impose very severe restrictions on imports. Unfortunately, reprographic equipment and materials (along with conventional photographic items) came to be classified among luxury goods. The quotas of even the big importing houses with international affiliations (Kodak Limited, Ilford Limited, Agfa India Limited, Allied Photographics Limited, the Scientific Instruments Company Limited etc.) were reduced progressively and drastically, within a few years, to 2 1/2 to 5% of what they were previously importing. This policy eventually strangled the possibilities of extension of use of reprographic techniques in India, based on imports.

This situation, which still prevails, was not without its blessings as in other fields, where imports were not possible. The artificial scarcity conditions have given some stimulus to indigenous design and production efforts.

Indigenous Production of Equipment for Reprography

A quick survey of the field today reveals the following bird's eye view. Simple contact printers for document reproduction are being made by two or three firms; these do not have vacuum contact facility, but are good enough for reflex copying from loose-leaf documents and thin pamphlets and journals. The principal manufacturers in this field are - (1) Agfa-Gevaert India Limited, Bombay (and branches), (2) M/s K.B. Industries, Lucknow and (3) M/s H.I. Prince & Company, Bombay.

There has been a remarkable achievement in the diazo field. While diazo papers were being manufactured by 4 or 5 firms in the country, for quite some time (though on a small scale), diazo printers were not indigenously produced in India until some 8 or 9 years back. With humble beginnings the industry has made rapid strides, though not in quantity, but definitely in quality. M/s Kilburn & Company with headquarters in Calcutta are producing a range of stationary and rotary diazo printers, in technical collaboration with M/s Hall Harding of UK; M/s Das Reprographics Ltd., also at Calcutta, have recently introduced a range of diazo printers based on original designs of M/s Van der Grinten of Venlo, Netherlands, pioneers in the semi-wet diazo process. Printers, developing units and combination units of the Van der Grinten types are being made by Das Reprographics. A sister concern (Das Zimmermann & Co.) has been producing simple diazo printers and auxiliaries in collaboration with A.M. Zimmermann & Cie. of West Germany. M/s Mahomed Ebrahim & Co. and NuWood Industries (P) Ltd. both at Madras, are making office copiers and plan printers, respectively, for diazography, both lines being marketed by Kilburns. Even though both the ranges of machines are engineered and fabricated in the country the ultra-violet tubes are still being imported. The special phosphors required for actinic blue emission are not being manufactured in India, though a lot of developmental work for this has been successfully completed in some of the research laboratories in the country; hence, though the conventional flourescent tubes for domestic and public illumination are manufactured in the country the special tubes giving the UV-output required for diazo printers are not. One factor inhibiting this manufacture may be the want of adequate demand, to justify mass production (of this special type) though the technological competence may be there.

In the duplicating field, a number of cheap hectographic duplicators are being made by small firms. Among the stencil duplicators the world famous firm of Gestetners are the only ones manufacturing rotary stencil duplicators (both electrical and manual models), in India.

Regarding offset-printing, so far there has been no indigenous production, though simple printing machinery for letterpress printing (and textile printing) as well as ancillary equipment like paper guillotines, stitching and binding machines are being made. A factory is being set up in the industrial city of Coimbatore in South India which will shortly manufacture a range of offset printing machines in collaboration with the firm of MGD (Meihle, Goss and Dexter) of USA.

In collaboration with Pictorial Machinery Ltd, the Monotype Corporation of India have set up a plant in Bangalore for manufacture of process cameras, whirlers and vacuum printers (for offset plate-making) retouching and layout tables etc. Except the lens and prism all the other parts are made in India.

Shevade's Camera Works in Belgaum, Mysore State, are making custom-built process cameras using imported lens and prism elements.

Only one type of microfilm reader is being made in India - the 'OFDUN' - designed and produced by the Ordnance Factory at Dehra Dun. An improvement over the Microvist this instrument has a lens also designed, cut and polished by that factory in India itself, and has a streamlined look with a collapsible folding mirror for projection of the magnified image. Demand for microfilm readers has been sporadic and regular manufacture on commercial scale has not been feasible. Insdoc has sought to break this impasse by acquiring a few pieces and hiring them out on rental to institutions wanting them.

Materials for Reprography - Indigenous Production

There have been some attempts in the past to produce photographic films and papers in India. None of these were organised in a big way; while some were successful initially they withered away for want of sufficient encouragement and financial backing.

I must mention here the successful, pioneering efforts made by my friend and former colleague Dr J.V. Karandikar, to produce photographic sensitive material under a grant from the Council of Scientific & Industrial Research in the early 1940's. Some of these earlier developmental efforts still survive, perhaps under different ownerships. Lantern plates for making diapositives, positive-type emulsion coated on flexible translucent base material to provide the so called "translites" for advertising and publicity purposes and contact printing papers fall in this category.

Large scale manufacture of photographic materials was first organised in India by the New India Industries Limited at Bombay in technical and financial collaboration with Agfa Leverkusen, West Germany. Consequent on the merger of the two European giants in the photographic field (Agfa of Germany and Gevaert of Belgium) the two former Indian distributing agencies of the parent firms namely Agfa India Limited and Allied Photographic Ltd. have merged into Agfa-Gevaert India Limited and they distribute, among other articles, the products of the Bombay factory of NII. The range of manufacture now covers Agfastat, Copex and Agepe papers meant for reprographic use. The demand is growing and the ceilings on the import of raw materials do not enable the factory to increase production sufficiently to meet the entire demand. Though the product can be said to be Indian, very little of it is of purely Indian origin. The base paper is imported and so is the silver nitrate, gelatine and other basic chemicals.

There is great scope, in India, for diversification of production. Even in the silver halide system there are such innovations which have given tremendous impetus to reprographic applications: (a) direct positive paper (based on the Herschel effect); (b) the developer impregnated paper for the stabilisation process; (c) diffusion transfer (Copyrapid-type), and soft gelatine transfer (Verifax-type) materials. None of these, nor even the conventional paper - either of the low-speed contact-printing variety or the high-speed projection-printing variety -- on special lightweight (air mail) base, is manufactured in India. They are not available also through import.

Two other firms who have made a mark in producing good quality photographic paper for reprographic applications deserve mention-they are Adross Private Limited, Calcutta and Libra Photo Industries at Podanur in Madras State. The efforts of these three (including New India) enterprises who have overcome some initial difficulties and have now established themselves as producers of dependable quality photo-materials, have to be appreciated.

The only manufacturer of photographic film in India, on a large scale, is the state-owned Hindustan Photo Films Manufacturing Company at the lovely hill station of Ootacamund in Madras State. This Company was set up in 1959-60 by the Government of India in collaboration with the French firm of Bauchet and Company (which has recently been taken over by the American giant, 3M Company of Minnesota). This enterprise has a modern factory at an altitude of about 2.3 kms. above sea-level, ensuring a temperate, moderately cool climate. Power and water are abundantly available, though an artificial water reservoir had to be designed for the sake of this factory. Only in July 1967, the Prime Minister of India, Smt. Indira Gandhi formally switched on the plant. The present production is confined to positive and negative film material required by the cinema industry. The Indian entertainment film industry has, for a long time, been second only to the USA in the quantity of films produced and it has recently been pushed to the third position by Japan.

Next in the order of priority for production by this factory is X-ray film, both for medical and for industrial use; small quantities of which have already been released in the market. Films for amateur use and the photographic trade, portrait studios, etc, are yet to be made available by this factory out of its own production; film manufactured in France has been imported, during the past few years, by the HPF, in bulk, the cutting and finishing operations being done at Ooty before distribution.

Materials specially meant for reprographic use are yet to be produced by this factory Microfilm having extremely fine grain and high resolution as well as high contrast is not beyond the present capability of this factory, and so is the process film required by the graphic arts industry, but commercial considerations appear to have influenced the decision of the

and stabilise their market for those items in which, quantity-wise, the demand is heaviest. Very successful development work had been concluded in this laboratory, even at the beginning of 1965, for the production of X-ray films, colour printing paper and some other specialised photographic materials.

The lion's share of the market for diazo paper, produced indigenously, has been captured by Messrs. Kilburn and Company. Thi firm manufactures both ammonia and semi-dry types of paper on opaque base as well as on translucent base (Kilburn 'reproduction paper') for further reproduction. With a network of branches in major cities providing retail outlooks the firm also has established reprographic service centres in these branches. Customers can walk in with their documents and get copies made (on diazo paper) whilst they wait. Curiously, these service centres also use silver halide papers to produce copies of opaque or double-sided originals which cannot be conveniently copied by the diazo process.

The firm of Das Reprographics Pvt. Ltd. also manufacture diazo paper. A number of smaller companies also produce similar material. Still, the amazing variety in base thickness, opacity, colour of the final image, etc., which are available in the foreign brands made in France, Germany, Japan, the Netherlands, U.K. and U.S.A., are yet to be made available to the Indian consumer of diazo.

Materials for duplicating processes

For stencil duplication the wax-coated stencil sheets are manufactured in India, though some ingredients for the coating are said to be imported, by Gestetner Duplicators Private Ltd.

For offset-printing the printing-masters (aluminium or paper) are available only through imports. In recent years, to conserve foreign exchange, the Government of India have concluded trade agreements with many of the socialist countries in Eastern Europe who have agreed to export a range of items and accept payment in Indian rupees, in addition to barter arrangements against Indian exports. This facility has been utilised to import aluminium foils for offset-printing from Czechoslovakia. In 1966 the Central Electrochemical Research Institute at Karaikudi, Madras State, successfully developed the process of electrochemical treatment of aluminium foils of suitable thickness to obtain a granulated surface fit enough for accepting thin layers of printing ink or water. Commercial exploitation of this development has already been licensed and it is hoped that Indian-made offset-printing plates will be available in 1968.

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Recently, there was a minor crisis in the offset printing and lithographic industry. Desiccated egg albumen, in the form of flakes or granules, required for preparing the sensitiser for litho plates was being wholly imported. Cuts in import quotas and speculative operations caused real and artificial scarcities. At the instance of INSDOC, the Central Food Technological Research Institute at Mysore have recently developed a process for manufacturing egg albumen granules. This process will shortly be licensed for commercial production. Though the above two are very small aspects in the entire field of materials for reprography, this is mentioned to indicate that Indian ingenuity and competence can be counted upon to rise to the occasion when a problem of import substitution is faced squarely and earnestly. With similar impetus it is considered that many of the other materials for reprography would get progressively manufactured within India.

Both the Monotype Corporation and Best & Co. are separately marketing Indian-made arc carbons needed for the U-V light sources in reprographic work.

At present there is no production of either equipment or materials for the thermal and electrostatic processes. A beginning has, however, been made for development of the "Electrofax" type of electro-photographic materials within India. The Central Electrochemical Research Institute has made certain interesting experiments with indigenous materials to arrive at suitable compositions for a developing powder containing pigmented resin, for use with zinc-oxide-coated papers.

Further developments are anxiously awaited. The Toshiba Autofax machine now at INSDOC, Bangalore, is proposed to be used for the field trials of the developing powder and eventually of the zinc-oxide paper which this laboratory hopes to produce through its R & D efforts.

From the above it can be seen that the reprographic industry in India is in its infancy. With the increasing tempo of economic development, increasing paper work and records management problems will require more and varied use of reprography. There is an enormous potential for the consumption of both equipment and materials as well as reprographic services to industry, business, government, academic and cultural organisations in the country.

Training of Technicians and Management in Reprography

Insdoc has played a pioneering role in providing training in reprography of a high standard. In a one-year long course devoted to documentation and reprography started in 1964, the main centre of Insdoc at New Delhi has been training batches of information scientists. The syllabus in reprography spans the entire gamut of systems, processes, methods and techniques now perfected and prevalent in India as well as in the advanced countries of the world.

Occasional intensive courses had been organised by the Insdoc to an international team of trainees from south-east Asian countries once in 1956-57 and more recently in 1963; the trainees came from as far away as Egypt in the West and South Korea in the East, with many from Indonesia, Malaysia, Nepal, Singapore, Thailand, etc.

There is a need for different kinds of training courses properly tailored to meet the requirements of different categories of people engaged in reprographic organisation and service. There should be one course for technicians and operatives, lasting from 9 to 12 months, which can give a proper orientation and ensure a thorough grasp of basic principles of reprographic systems besides giving adequate practical training in the operation and maintenance of reprographic equipment and the proper choice and use of materials. There could be another refresher course of short duration for those who have already gained some practical experience in reprographic work. There could be yet another course for managers and executives who have to deliver the goods by proper organisation and management of reprographic units - whether these are service organisations or set up mainly to meet internal needs within industries or academic/governmental departments. Such courses are best planned and organised by a central national body devoted to reprographic advancement. There is need and scope for an organisation in India to function on the lines of the Institute of Reprographic Technology, London, or the Society of Reproduction Engineers, U.S.A., and similar bodies elsewhere. Support from both government and industry will be needed, in terms much deeper than mere moral support and encouragement.

Standardization of Reprographic Matters

The Indian Standards Institution, the national body responsible for standards in India has given attention to the establishment of the necessary standards and recommended practices in certain aspects of reprography. For more than a decade a sub-committee with code number EC2:2 has been fairly active in these matters, under the Documentation Sectional Committee of the ISI. Besides commenting on the draft recommendations proposed for approval by the International Standards Organization, this committee also has been pursuing the drafting of standards for use within the country. Standard codes of practices have been drafted, studied, commented upon and finally approved on the following topics:

1. Storage and use of microfilms of permanent value (IS:3130 - 1965)
2. Processing of microfilm.

Work is in progress concerning a code on the avoidance of damage to microfilms and another on the quality aspects of microfilm. More standardisation work will be pursued when the range, variety and quantity of equipment and/or materials for reprography produced in India increase in the future. Due regard has to be paid to the climatic conditions as well as technoeconomic levels of living and organizational practices in the country, while devising either quantitative or qualitative standards in the field of reprography. No doubt as far as possible conformity with the high levels of standards already existing in the field in some countries has to be aimed at, making departures only when the conditions peculiar to the country warrant. There is scope for associating a greater variety of people (having technical and scientific expertise in the design, development, production as well as use of reprographic systems) in the standardization activities of the ISI in this field.

Conclusion

The description given above gives a more or less correct picture, though not very exhaustive and perhaps accurate, of the state of reprography in India. The imperative need at present is for steps to be taken in the following directions:

A national organization has to be formed for the promotion of reprographic activities and propagation of current knowledge regarding developments and its applications in this fast-developing vast field, to potential users in the country.

A more intensive effort has to be made to catalyse developmental work in the indigenous production of reprographic equipment and materials. The available attempts that have been made so far, though successful, cover only a few stray aspects of reprography. Indigenous know-how has been (or is being) developed, without any foreign collaboration, only in such areas as aluminium foils for offset-printing; egg albumen for sensitizing aluminium foils, tribo-electric, pigmented resinous powder complex for developing 'Electrofax' paper etc. It is feasible to successfully develop some of the more sophisticated equipment and materials for reprography within India, like stabilization and diffusion transfer processors, diazo coated film, 'Electrofax' - type copies etc. There is sufficient engineering and scientific talent of proper calibre is available. What is needed is the impetus and perhaps an incentive for such developmental work. The importance of reprographic systems, as one of the essential labour-saving and economising devices in all walks of national activity, has to be brought home to people who matter.

Attention has to be paid to establishing a permanent machinery (and an advisory body for it) for running regular and continual training programmes in reprography at various levels.

A central advisory body composed of experienced people should be set up for the screening and clearance of proposals for establishment of reprographic units in industries, business houses, government departments, research laboratories, universities, etc. for the whole country. This will help to minimise, if not completely to eliminate, the somewhat chaotic conditions prevailing at present wherein one often finds ill-advised choice of equipment, not being fully utilised or, in some cases, systems are set up with equipment not adequately suited to the requirements, or for which materials and spares cannot be obtained easily in India.

In view of its achievement in the economic progress & nation building activities, India has already assumed a leading role, in many fields, among the developing nations. It has to take the initiative in establishing international co-operation in reprography, particularly among the developing countries. Such co-operation can take the form of combined activities in training programmes, research and development work and judicious adopting and adaptation of sophisticated systems that have been established in the more advanced countries.

THE ANGLO-AMERICAN CATALOGING RULES WITH EMPHASIS ON RULE 6 (SERIALS)

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The rules relating to the choice of heading for serials in the Anglo-American Cataloging Rules, 1967 are discussed. The principle behind corporate entry for some serials is also discussed in the context of the Paris Principles and practice in the union catalogues.

Introduction

Examining the rules relating to 'Works of Shared Authorship' in the new cataloguing code, and the principles governing them, we have observed that rationalisation and simplification in the rules have been effected successfully, exemplifying the claim that the new code has been built on well thoughtout principles [6]. In this paper, we are turning our attention to rules relating to cataloguing of serials to see if the same rational approaches are equally effective here also. The scope of this paper also includes a consideration of the cataloguing practices of union catalogues vis-a-vis the publication of this new code. The desirability of standard practice for union catalogues of serials cannot be exaggerated and this aspect is also stressed at the end of the paper.

Rule 6 of the Code

A fundamental approach that has largely guided the framing of new rules for entry and heading in the Anglo-American Cataloguing Code — as has often been observed — has been the focussing of attention on types of authorship of works rather than types of works. Indeed a correct lead had already been given by Lubetzky's Draft Code, followed by the guiding principles laid down by the Paris Conference. As a natural consequence of this sensible approach, a great number of rules dealing with specific types of documents in the American Association Code of 1949, have been brought together into a fewer number of rules, and this point was illustrated in our discussion on the treatment of 'Works of Shared Authorship' [6]. 'Serials' is another area where such a reduction of rules has been possible. In the new code, Rule 6 with its sub-divisions take care of serials of all varieties, as against the thirteen rules prescribed by the American Library Association Code 5C(1) - (4), 5D, 5E(1) - (4) and 5F(1) - (2) [2]. An examination of these rules makes it clear that there is little justification for the prescription of separate rules for periodicals, newspapers, almanacs, yearbooks, directories, series, etc., as all of these represent a single category, requiring perhaps, a unique but all the same uniform treatment. Commenting on this "fine distinction between the various kinds of serials with special rules for each", Professor Dunkin dismisses this as "pedantic and superfluous" [4]. Endorsing this view in toto, the new code has abandoned separate rules for the entry for serials under title, under corporate author or under personal author. Mention may be made here of a dissenting view also, expressed by Porter, editor of the British Union Catalogue of Periodicals, who regrets that the Paris Conference unfortunately do not treat serials as a 'distinct' category and has comparitively very little to say about them [11].

For purposes of easy reference, Rule 6 and its sub-divisions are quoted below [2]:

6A Enter a serial that is not issued by or under the authority of a corporate body and is not of personal authorship under its title.

6B1 Enter a periodical, monographic series, or a serially published bibliography, index, directory, biographical dictionary, almanac, or yearbook, issued by or under the authority of a corporate body, under its title with an added entry under the corporate body.

Exception: If the title (exclusive of the subtitle) includes the name or the abbreviations of the name of the corporate body or consists solely, of a generic term that requires the name of the body for adequate identification of the serial, enter it under the body.

6B2 Enter any other serial issued by or under the authority of a corporate body under the body. In case of doubt that the serial is covered by 1 above enter under the body.

6C Enter a serial by a personal author under his name.

6D1 If the title of a serial changes, if the corporate body under which it is entered changes or undergoes a change of name, or if the person under whom it is entered ceases to be its author, make a separate entry for the issues appearing after the change.

6D2 If the corporate body accorded an added entry for a serial changes or undergoes a change of name, make an added entry under the new body or on the new name of the body.

Clarity in the Rules

Apart from the welcome reduction in the number of rules, introducing rationalisation in them and with comprehensiveness, the new code is unequivocal in the drafting of the rules which was conspicuously absent in the American Library Association Code of 1949. The liberal interpretation of the word 'distinctive' used in the American Library Association Code rules for 'Periodicals and Serials', combined with the cataloguers enthusiasm for corporate entry, a great deal of inconsistencies have crept in many catalogues. There are numerous instances to prove this point, but to mention only a few, in the Library of Congress Catalogue, the Library Association Record has been accorded a title entry whereas the Library Association Yearbook has been catalogued under the corporate name. Another interesting instance is given by Professor Dunkin, where a user finds some of his scholarly journals entered under title and some under corporate body. "Papers of the Bibliographical Society of America, for instance, he will find under Bibliographical Society of America, while the Library of the Bibliographical Society (London) he will find under Library. If he is a reasoning and reasonable man he may decide that this is because one journal has a distinctive title. What will he then think when he finds that Studies in Bibliography of the Bibliographical Society of the University of Virginia is entered under Virginia University. Bibliographical Society? Yet this is precisely what ALA rules stipulate" [4]. Now in the new code, no such scope is given for varying interpretations. The title mentioned above will go under Studies in bibliography; papers of the Bibliographical Society of the University of Virginia. The rules are thus perfectly clear and if they are applied understandingly, along with the footnotes which give proper guidance, there is hardly any chance for inconsistencies.

Swerve from the Paris Principles

While effecting the desirable changes mentioned in the foregoing paragraphs, the Anglo-American Cataloguing Rules has significantly maintained the traditional stand of recognising the twin principle of author and title entry for serials also. But the Paris Conference categorically recommended title entry for serials and periodicals. This swerve of the new code from the Paris Principles, while it is possible to justify by logical argument, would unfortunately perpetuate the present divergent cataloguing practice, contrary to the result that was sought to be achieved by the Paris Conference.

At this point, it may be useful to recapitulate in brief, the deliberations that went on at the Paris Conference on this area of cataloguing. Professor Dunkin, in addition to contributing a working paper on serials for the Conference, circulated a questionnaire on the subject to elicit the opinions of the participating countries. The replies to this questionnaire reveal some interesting points. In regard to accepting corporate authorship for serials, nearly twelve of the twenty-six countries gave replies in the affirmative, but limited to certain categories of serial publications. An interesting idea that emerged from the comments, supporting this particular stand, was that the main entry under the corporate body need not imply that the corporate body was the author of the publication.

American thinking in this respect also corresponds to this view as reflected in the new code. Professor Dunkin's own proposals which obviously had considerable effect on the new code were: 1) If the serial was the official statement of the corporate body's policy, or a statement of its business, it should be entered under the body; and 2) All other serials should be entered under titles. The new code follows these proposals, more or less, a discussion of which follows [4].

Principles underlying Rule 6

By implication and design, the Anglo-American Cataloguing Rules places serials under the category of works of diffused authorship. In accordance with the general principle 4 (Entry should be under title in the case of other works whose authorship is diffuse, indeterminate or unknown), Rule 6A and 6B1 prescribe title entry for serials that are serially published bibliography, index, directory, biographical dictionary, almanac or yearbook, whether or not these are issued by or under the authority of a corporate body. This is in conformity with the general belief that the most natural entry for serials is the title entry which is, according to Jolley, "the almost universally accepted method" [8]. But the subsequent Rules 6B1(Exception), and 6B2 prescribe entry under the corporate body for (1) serials that include the name or abbreviations of the name of the corporate body for adequate identification and (2) other categories of serials such as annual reports and others that give an account of the activities of the body. As pointed out earlier, the new code depart from the Paris Principle in this respect. The Catalog Code Revision Committee, after a good deal of deliberations on this point, maintains that "the inclusion in the title of a serial of the name or part of the name of issuing body is too powerful a criterion to be nullified when, in unusual cases, no account of the activities of the body is included in the publication" [2]. It also holds that "known primarily or conventionally by title" as given in the Paris Principle "is too vague a criterion" [2]. But what is the principle that should guide cataloguers in fixing the entry for serials of this type?

In searching for a new principle that should assist cataloguers in their practice, Jolley's pragmatic criteria for authorship comes in very handy. He holds that the term authorship implies the concept of both intellectual responsibility and of the name most permanently associated with a work. Therefore when a serial is sponsored by or "issued by or under the authority of a corporate body", there is every justification to give a corporate entry for this serial, although the intellectual responsibility for the work is diffused. This is exactly the idea that emerged out at the Paris Conference on this issue, a reference to which has already been made. This has been developed as a counter-principle for works, the intellectual responsibility of which is diffuse but yet entered under the corporate body that is closely associated with it. Sumner Spalding the general editor of the Anglo-American Cataloguing Rules, has introduced two more principles, apart from the two 'great principles', to justify some of the decisions taken in relation to the rules of entry in the new code. They are the principle of 'Category' which is applied to certain types of works in law, and the principle of 'Name most strongly associated with the work', which is followed for serials with titles that contain the name or abbreviation of the name of the corporate body even if the authorship of the content of the work is diffuse [14].

Change of title

The questionnaire circulated by Professor Dunkin prior to the Paris Conference, referred to earlier, brought out an overwhelmingly favourable opinion in the matter of an important aspect of serial cataloguing, which has given rise to varying practices. This refers to serials that change their titles or the corporate body that issues a serial, changes its name. The Paris Conference recommended entry under successive titles for a serial publication issued successively under different titles, with indication of at least the immediately preceding and succeeding titles. In the new code also, Rule 6D and its subdivisions provide for entry under successive titles for this category of serials. The only question here is whether or not this provision satisfied the twin objectives viz. to facilitate the location of a particular publication and to relate together the works of a given author and the editions of a given work. But this apparent clash between the two objectives could be easily overcome by providing a history section in the entry which would give the complete history of the serial. This serves both the objectives, but does so only by having an indefinite number of repetitious entries for each serial. This is what is prescribed by Dr Ranganathan in his Classified Catalogue Code, and is also followed by union catalogues of scientific serials published by Insdoc. The Library of Congress, is however, allowed to continue its old practice of cataloguing such serials under the latest title and the latest name of the issuing body which is the old practice of the ALA Code. The reason for this is "that libraries depend on the bibliographical information which the LC cards provide when a serial is catalogued as one entry under its latest title or corporate author, which is too valuable to lose" [5].

Standardisation in union catalogues

The ostensible purpose of the International Conference on Cataloguing Principles was to foster the movement towards uniformity – both national and international – in library catalogues and similar lists. But a code, that has come out five years after this historic conference, which will be widely used and which will influence greatly cataloguing practice, has departed from the Principle on a very important area of cataloguing. As against the practice suggested by new code, the BUCOP always makes its main entry under the published title reflecting the Paris Principle. The Classified Catalogue Code also prescribes title entry for serials, rejecting the corporate author principle outright. Dr Ranganathan is of the strong view that a mere sponsor could never be deemed an author under any circumstances. The extension of the definition of author suggested by Jolley or the new principle given by Sumner Spalding, is obviously not acceptable to him. In these circumstances, therefore, divergent practices in the preparation of union catalogues in serials will be perpetuated much to the chagrin of users.

Finding that standardisation in this respect could not possibly be achieved, as both the American version and the British version of the new code have departed from the Paris Principle, Porter suggests the solution by tackling this problem at the source. He cites the British Standard (2509:1959) for the layout of periodicals, conforming to the main recommendations of the International Standard (ISO/R 8) for introducing standardisation in the publications of serials. In view of the intrinsic value of these suggestions, they are quoted verbatim here: "Primarily a serial ought to have a clear-cut and self-explanatory title. Great care should be taken in selecting it, so that there should be no urgent need to change it, at least for a few years. The title should be printed clearly on the title page or its equivalent, without typographical variations that might suggest that a particular phrase is not an essential part of the title but merely an embellishment. On no account should a cover title or running title differ from the one on the title page — except, perhaps, for an adequate and recognizable abbreviation. Scholarly serials should avoid 'cute' titles especially if they include a more informative subtitle. The use of initials in, or as, a title should be carefully pondered. Multiplicity of titles should be avoided, unless there is a good reason for them, as in the case of multilingual serials. Preferably, a serial should have a single title; or if it is felt to be necessary to include a more general series title, or a subseries title, one should be given clear priority over the others, typographically and by numbering.. It is inadvisable to include a word denoting frequency in a title, if it is adequate without it, both because it could be embarrasing if the publication programme had to be altered and because, if it appears to be superfluous, it might be dropped by cataloguers or overlooked by catalogue users". For serials published by corporate bodies, he suggests, "if the serial comprises papers submitted by members, for which the body is not disposed to accept collective responsibility, it might be advisable to omit the body's name from the title. The topic phrase from the body's name could serve as an alternative, however, or such a phrase preceded by 'Journal of...' or 'Australian journal of...' as appropriate. Assuming, however, that the name of the body is to be included in the title, should be genious of the language decide the way it is to appear? Oriental languages, and European languages of an oriental bent, appear to employ a word order which would find favour with those who prefer corporate entry" [11]. These suggestions are worth pondering, which sometime in the future may lead to some standard practice, which eventually may reduce the problems of serials cataloguing.

Schematic chart

A schematic chart is given summarising the rules relating to serial cataloguing. Notwithstanding the fact that there are departures from the recommendations of the Paris Conference, a conscious effort is made to base every rule on principles. Undoubtedly this is a better way than what had been.

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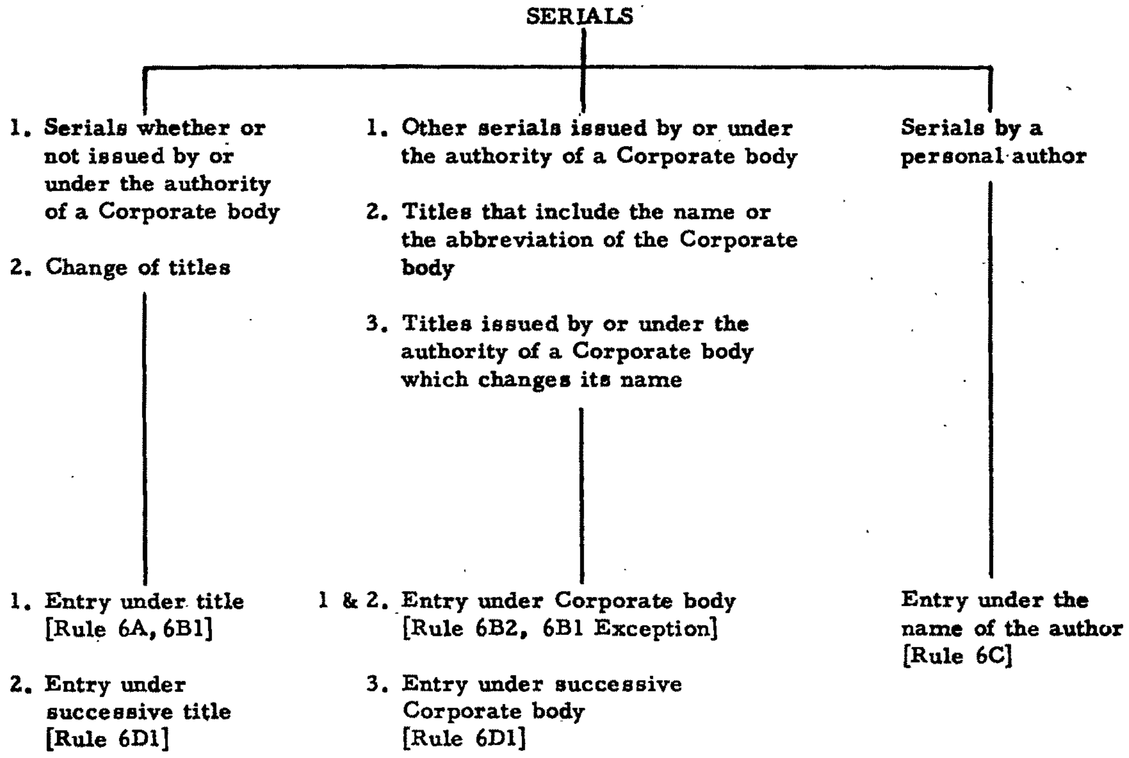

SERIALS

1. Serials whether or not issued by or under the authority of a Corporate body
2. Change of titles

1. Entry under title [Rule 6A, 6B1]
2. Entry under successive title [Rule 6D1]

1. Other serials issued by or under the authority of a Corporate body
2. Titles that include the name or the abbreviation of the Corporate body
3. Titles issued by or under the authority of a Corporate body which changes its name

1 & 2. Entry under Corporate body [Rule 6B2, 6B1 Exception]

3. Entry under successive Corporate body [Rule 6D1]

Serials by a personal author

Entry under the name of the author [Rule 6C]

CURRENT DOCUMENTATION LITERATURE

LIST OF PERIODICALS COVERED IN THIS ISSUE

Note: Volume and issue numbers have been mentioned in each case.

ALA Bulletin [ALA Bull]	61(8,9,11)
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Australian Library Journal [Aust Lib J]	16(4)
Babel [Babel]	13(3,4)
Book Mark [Book Mark]	27(1)
British Journal of Photography [Brit J Photogr]	114(5599,5600)
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FID News Bulletin [FID News Bull]	17(10)
Indian Librarian [Indian Libn]	22(2,3)
Journal of Documentation [J Doc]	23(3)
Journal of Education for Librarianship [J Educ Librnship]	7(4),8(1)
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